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Soil Survey

of

The Santa Ynez Area, California

By

E. J. CARPENTER, in Charge, and T. W. GLASSEY
U. S. Department of Agriculture
and
R. EARL STORIE
University of California

Bureau of Chemistry and Soils
In Cooperation with the
University of California Agricultural Experiment Station

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By E. J. CARPENTER, in Charge, and T. W. GLASSEY, U. S. Department of Agriculture, and R. EARL STORIE, University of California

AREA SURVEYED

The Santa Ynez area is in the central and western parts of Santa Barbara County, one of the coast counties in the southwestern part of California. (Fig. 1.) Santa Barbara, the county seat, is in the southeastern part of the county about 45 miles by highway from the area surveyed.

The southern boundary of the area is formed largely by the Santa Ynez Mountains which separate the area from the Pacific Ocean on the south. On the west the area extends to the ocean and includes Point Sal Ridge in the northwestern part. On the north this area adjoins the previously surveyed Santa Maria area.[1] The foothills and steeper slopes of the San Rafael Mountains and the precipitous slopes of the Santa Ynez Mountains converging on the valley of the Santa Ynez River form the eastern boundary. The included area is 754 square miles or 482,560 acres.

FIGURE 1.—Sketch map showing location of the Santa Ynez area, California

Topographic sheets of the United States Geological Survey, in which some revision in culture was made where necessary, were used as a base in the construction of the soil map.

The surface features of the Santa Ynez area vary widely. The northern part of the area is occupied by the Casmalia Hills and Solomon Hills, which consist of low rounded or abruptly sloping hills or ridges ranging in elevation from sea level to 1,600 or more feet above. The Los Alamos Valley, in general about a mile wide and extending nearly due east and west, separates the northern hills from the Purisima Hills, which are more abrupt and rise to elevations of nearly 2,000 feet. Lying between the Purisima Hills and the Santa Ynez Mountains to the south is Santa Ynez Valley. In the eastern part of the area Santa Ynez Valley consists of narrow bottoms bordering Santa Ynez River and its tributaries. Near Santa Ynez the valley broadens rapidly and includes several terraces and alluvial fan slopes more or less dissected by streams entering Santa Ynez River which hugs the base of the mountains to

[1] WATSON, E. B., and SMITH, A. SOIL SURVEY OF THE SANTA MARIA AREA, CALIFORNIA. Field Operations Bur. of Soils, 1916. pp. 2531–2574. Illus.

the south. To the west of Buellton the valley again narrows between the Santa Rita Hills and the Santa Ynez Mountains. Santa Rita Valley, which consists of a very minor stream valley and low rounded hills, lies between the Purisima Hills on the north and the Santa Rita Hills on the south. El Jaro Creek, which drains a small intermountain valley in the Santa Ynez Mountains known locally as San Julian Valley, empties into Salsipuedes Creek which flows into Santa Ynez River just before it emerges from the Santa Rita Hills. In the vicinity of Lompoc the alluvial land bordering Santa Ynez River again broadens out to a comparatively wide alluvial plain which gradually narrows to a width of about a mile where Santa Ynez River empties into the Pacific Ocean. Bordering the ocean to the north and south of the river are broad level or gently undulating sandy terraces, probably of marine origin, which lie 300 or more feet above the river flood plain. These sandy terraces have been reworked and modified by the wind to a greater or less extent, especially where adjacent to the ocean, and in the vicinity of Narlon an area several square miles in extent consists largely of shifting sand dunes.

The bottom lands bordering Santa Ynez River and San Antonio Creek and their tributaries are narrow and generally are flanked with a series of terraces, of marine or stream-laid origin, which have been more or less eroded so that many upper terraces have a hilly or rolling relief. The lower terraces are smooth and gently sloping and are little marked by erosion. The hill slopes generally have a rounded contour, with little rock outcrop, and are covered with grasses, oaks, or brush.

Elevations within the main agricultural part of the surveyed area range from slightly above sea level to about 600 feet in the vicinity of Santa Ynez. Some of the smooth well-developed terrace and bottom lands bordering La Zaca and other creeks in the northern part of the area, and areas along Santa Ynez River range in elevation from 1,000 to 1,500 feet. A few peaks of the included mountainous areas attain elevations of 2,000 or 3,000 feet.

Santa Ynez River is the principal drainage outlet of the area. The drainage from the northern slopes of the Solomon and Casmalia Hills reaches Santa Maria River outside the area. A dike of resistant rock crossing San Antonio Creek has resulted in a poorly drained area several square miles in extent in the vicinity of Harriston. Other poorly drained areas occur near the mouth of Santa Ynez River and 1 mile northeast of Los Alamos. In the remainder of the area drainage is well developed.

Santa Barbara County is one of the 27 counties into which California was originally divided. It was created February 18, 1850, and Santa Barbara was made the county seat. At that time the population was largely of Spanish descent, and the county was sparsely settled. American settlement began in the late sixties and has continued steadily, except during occasional booms, to the present. Several colonization projects, one of the first of which was the settlement of Lompoc Valley by a temperance colony in 1874, attracted considerable attention to the area. A Danish colony founded around Solvang in 1911 is now a substantial community. Projects for subdivision and

settlement of lands which were unsuited to intensive farming resulted in much hardship and many failures.

Lompoc, the largest town in the area, had in 1920 a population of 1,876. This town is surrounded by a small but prosperous farming community. Modern small towns are scattered over the area. The farmers are progressive, and a number of farm bureau centers have been organized.

Population data directly applicable to the area surveyed can not be given, since available census figures deal only with the county as a whole. The census for 1920 reports 43.1 per cent of the population of Santa Barbara County as rural. The density of the rural population is 6.5 persons to the square mile. The most thickly settled area is in and around Lompoc, where the production of specialized crops requires much labor. Less thickly populated districts include the upper Santa Ynez Valley, Santa Rita Valley, and Los Alamos Valley. The outlying hilly or mountainous districts are sparsely populated.

The coast line of the Southern Pacific Railroad borders the ocean a few miles to the south of the area and affords railroad facilities for a portion of the upper and middle parts of Santa Ynez Valley. Mail, express, and more or less freight is hauled in trucks from the railroad station of Gaviota, just outside the area, over the Pacific Highway into the upper valley. In the western part of the area transportation facilities are better. A line of the Southern Pacific Railroad follows the coast line practically across the area, and a branch of the same road affords transportation to Lompoc and the lower valley points. The Pacific Coast Railway (narrow gage) enters the area surveyed at Divide. The area is well supplied with good roads. Main roads are paved and secondary roads are well graded and passable throughout the year.

Telephone service is good, and electricity for lighting and power is available in all the towns and on most farms. Tractors and automobiles are in general use, and a large proportion of the farmers have radios.

As the local demand absorbs but a small proportion of the agricultural products of the area, outside markets must be found for the surplus. Good transcontinental railroad service and the proximity of the area to ocean lines of transportation afford world-wide markets.

CLIMATE

The climate of the Santa Ynez area is mild, with few extremes of summer or winter temperatures. The winter seasons are short and are characterized by mild noonday temperatures, with occasional freezing weather at night during the months of December, January, and February. Pastures remain green, and no damage is ever done to winter-sown grain. Hardy vegetables can also be produced throughout winter. Near the ocean freezing weather is rare. In summer hot spells of more than a day's duration are seldom experienced, except in some of the smaller valleys shut off from the ocean breezes.

At Santa Maria the average dates of the latest and earliest killing frosts, respectively, are February 26 and November 25, and the latest and earliest recorded were on May 16 and September 22, respectively.

Fogs reaching far up the valleys are of frequent occurrence during winter. They come into the valleys at sundown and are generally dispersed late in the morning. Heavy dews are also usual at this season.

In late fall and winter there is very little wind, but in summer a wind movement from the cool areas bordering the ocean to the heated interior is common. The winds are cool and moist as they leave the ocean but lose their moisture and become hot and dry on passing into the heated interior valleys.

Approximately 90 per cent of the annual precipitation falls during the rainy season which commences in November and continues into March. The rains, which may continue for a few hours or for several days, are generally heavy and when continued over several days cause much erosion on light-textured soils, take out bridges, and otherwise damage property and crops. Rainfall is heaviest at the higher elevations. Within the agricultural section the highest rainfall occurs in the San Julian Valley, where the average is 8 to 10 inches greater than in other farming areas. The rainfall in the Los Alamos and Santa Ynez Valleys is practically the same, averaging about 17.25 inches a year.

The normal monthly, seasonal, and annual temperature at Santa Maria, a few miles north of the surveyed area but similar to it in temperature conditions, and the precipitation at Los Alamos, the only point in the area for which precipitation records are available are given in Table 1.

TABLE 1.—*Normal monthly, seasonal, and annual temperature*[1] *and precipitation*[2] *at Santa Maria and Los Alamos, Calif.*

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1917)	Total amount for the wettest year (1911)
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*
December	52.3	83	23	3.25	0.04	1.85
January	49.7	85	24	4.02	2.03	7.53
February	50.6	98	25	3.86	4.17	3.64
Winter	50.9	98	23	11.13	6.24	13.02
March	52.8	88	29	3.36	.43	12.41
April	55.2	98	28	.58	.19	1.47
May	59.0	96	32	.49	.23	(3)
Spring	55.7	98	28	4.43	.85	13.88
June	62.2	100	35	.03	.00	(3)
July	64.0	98	41	(3)	.00	(3)
August	64.3	95	31	.09	.00	.00
Summer	63.5	100	31	.12	.00	(3) .00
September	63.8	100	32	.32	.00	(3)
October	61.7	104	29	.40	.00	.00
November	56.2	92	21	.85	.00	.08
Fall	60.6	104	21	1.57	.00	.08
Year	57.6	104	21	17.25	7.09	26.98

[1] At Santa Maria (elevation, 220 feet). [2] At Los Alamos (elevation, 600 feet). [3] Trace.

AGRICULTURE

The first attempts at agricultural development in the Santa Ynez area date back to the coming of the mission fathers about 1787. Under the guidance of the padres the Indians were instructed in irrigation, and fruits and corn, wheat, and other cereals were produced on the mission grounds. The breeding of sheep and cattle were also encouraged by the mission fathers, and as early as 1810 the Mission La Purisima, near Lompoc, owned 20,000 head of livestock.[2] Owing to the lack of markets, livestock was valued only for the hide, wool, or tallow. With the secularization of the missions in 1835, their influence over the Indians was lost and agriculture declined.

Between 1837 and 1844 most of the agricultural lands of the area passed through large land grants by the Spanish Crown, from public to private ownership. Little farming was done at first by the large landowners who raised only sufficient fruits, cereals, or other staple products to supply local needs. The production of sheep and cattle was stimulated by a number of favorable years, and the livestock industry became important. Assessment records for 1863 gave a total of 200,000 cattle in Santa Barbara County. As a result of the dry years of 1863 and 1864 and the overstocking of the range, many cattle perished. By 1865 there were only about 5,000 in the county. As a result of the losses of this period most of the large ranchos were subdivided.

About this time the construction of a railroad was rumored, and as steamer transportation was already established, immigration increased and lands were readily disposed of at the low prices then prevailing. The dry years of 1876 and 1877 checked this boom and resulted disastrously to the sheep-raising industry, which had largely replaced the raising of cattle. One of the most important steps in the agricultural development of this period was the formation of the Lompoc Valley Co. which bought the ranchos Lompoc and Mission La Purisima, totaling about 46,000 acres, and established an agricultural colony.

The completion of the Southern Pacific Railroad to Santa Barbara from Los Angeles in August, 1887, and the extension of the line from the north to connect at Santa Barbara in March, 1901, greatly stimulated agricultural development.

Census figures dealing directly with the area surveyed are not available, but the United States census figures for Santa Barbara County show the trend of agriculture in the area. The census of 1880 shows 18,492 acres in wheat in 1879, 13,598 acres in barley, 8,251 acres in hay, and 3,167 acres in corn. In addition some potatoes, beans, dry peas, oats, and buckwheat were grown. Orchard products were valued at $15,507.

The census for 1900 listed dairy products for the first time, reporting their value as $213,045 in 1899. In the next decade the agriculture of the area became more diversified and stable. The production of vegetables, with a value of $244,205 in 1909, and of fruits and nuts, with a value of $538,465 in the same year, had as-

[2] STORKE, Y. A. A MEMORIAL AND BIOGRAPHICAL HISTORY OF THE COUNTIES OF SANTA BARBARA, SAN LUIS OBISPO, AND VENTURA, CALIFORNIA. 677 pp., illus. Chicago, 1891.

sumed importance. The production of wheat, barley, and corn had decreased, but with the growth of the dairy industry the acreage of hay and forage had increased. Poultry production also was becoming important.

The character of the present agriculture of the area is shown by the census of 1925, which reports the value of all crops in the county in 1924 as $2,409,311 and of livestock as $2,384,031. The value of fruits and nuts has increased enormously since 1910, as has also that of beans, one of the most valuable crops in the county. In 1924 the combined acreage of wheat, oats, and barley was only 12,417 acres. The acreage devoted to these crops will probably remain fairly stationary, as lands unsuited to other crops continue to be used in their production. Dairying and poultry raising will no doubt assume greater importance as an accepted agricultural program is developed. The production of fruits and nuts will no doubt continue to increase in sections suited to their culture. Sugar beets for sugar were grown on 6,895 acres in 1924. An important agricultural commodity produced largely in the area, but not listed in the census, is mustard seed. The county horticultural commissioner's report for 1925 shows 2,810,000 pounds of mustard seed, with a value of $182,650, produced in the surveyed area on 4,350 acres. The lower Santa Ynez Valley is widely known for its production of mustard, it being reported that about 90 per cent of that grown in the United States is produced there. Flower seeds are also produced in large quantities, largely in Lompoc Valley, and some garden seeds are grown.

The soils of the Altamont, Zaca, Montezuma, Ballard, and Tierra series are used largely in the production of beans, in rotation with wheat or barley. Other hill and mesa soils are generally devoted largely to grain production, except in seasons of high rainfall when beans are grown on the better soils. The soils of the Metz series in and around Lompoc are used largely in the production of beans, flower seeds, mustard, and sugar beets. Other recently deposited alluvial soils are devoted to beans, mustard, barley, alfalfa, and, to some extent, to sugar beets where transportation facilities are good. Some deciduous fruits and walnuts are successfully produced on several of the recent alluvial soils.

It is general practice to rotate beans with sugar beets or barley. The beans are grown on the same land for two or three years, then are followed by barley or sugar beets. The bean straw is generally burned, though a few farmers turn it under to maintain the organic-matter supply. Lands leased by sugar-beet companies are cropped to beets for several years, a rotation with beans being practiced only when yields fall off to a very marked extent or the fields become infested with pests. The better flower-seed ranchers plant beans every second or third year. Care must be exercised in handling fields devoted to flowers to keep out disease and foreign seed. Much necessary handwork in planting, roguing, and harvesting makes flower seeds an expensive crop to grow.

The principal varieties of beans grown in the area are the baby Limas, the navy, and Bluepods. The baby Lima has been developed in recent years and gives excellent returns, being grown largely in the San Julian Valley and on Zaca clay elsewhere throughout the

area. In seasons of very high rainfall this bean makes a heavy vine growth and does not mature in the region bordering the ocean. Yields of this variety average slightly less than of the navy bean, except on the heavier-textured soils. The crop is well suited to this region and is comparatively free from pests. Hot winds at blooming time sometimes materially reduce yields of beans in the valleys removed from the moderating influence of ocean breezes.

The climate and soils are well suited to sugar-beet production though owing to various pests the acreage in the Santa Ynez area is gradually declining. Nematodes are the worst pests and can be controlled only with difficulty.

The two varieties of mustard grown in the area on a commercial scale are the red and yellow. The red mustard gives heavier yields, yellow mustard having a hollow stalk which frequently breaks off when heavily loaded with seed and subjected to high winds. The yellow mustard, however, is valued about a cent a pound higher than the red. About 3,500 acres of red mustard are grown in the area and from 500 to 1,000 acres of yellow. Yields of red mustard average about 10 sacks of 100 pounds each to the acre and of yellow 8 or 9 sacks.

Farm buildings in the Santa Ynez area are generally modern and well kept. Most of the houses are comfortable, well built, and equipped with running water and many modern conveniences. The barns are generally of fair or poor construction but are sufficiently good to care for livestock under existing climatic conditions. The work animals are well bred and of medium weight. One or more light or medium weight tractors are found on most farms. Most of the milk cows are poor grade, but on some of the better dairies well-bred Holsteins are kept. Range cattle are almost entirely of the Hereford breed. The bulls are generally purebred, and the herds are being gradually built up.

Little money is spent on commercial fertilizers in the area, as a crop rotation and the turning under of green-manure crops or the application of barnyard manure have proved efficient in maintaining yields up to the present.

Farmers engaged in the production of sugar beets, vegetables, and flower seeds employ considerable outside labor. Most of the farm laborers are Mexicans, Japanese, and Italians, and they are dependable and efficient. Labor is generally plentiful. Day labor is paid $3 or $3.50. Much of the work on specialized crops is on a contract basis.

Many farms are owned in large tracts and divided among renters. The average size of the farms on the river-bottom soils is from 60 to 100 acres. The farms containing much hill land, a considerable proportion of which may be waste land, average between 300 and 400 acres in extent. Cattle and sheep ranches embrace from 2,000 to 15,000 or more acres.

In Santa Barbara County in 1925, 34.2 per cent of the farms were operated by tenants and most of the remainder by owners. This represents in a general way conditions of tenancy within the area surveyed. Most renting, especially of bean or grain land, is on the share basis, the renter furnishing everything and receiving three-fourths of the crop. Land for seed or vegetable production is rented

on a cash basis, the prices ranging from $40 to $60 an acre depending on the type of soil and the crop to be grown.

The better-improved river-bottom soils in the vicinity of Lompoc are held at prices ranging from $450 to $600 an acre. Those in orchards are valued higher. Unirrigated recent-alluvial soils are valued between $150 and $250 an acre. Hill lands under cultivation are considered to be worth from $50 to $75 an acre, and the upper terrace lands command from $40 to $125 an acre, depending on the type of soil and location. Grazing lands are assessed at $1 an acre.

SOILS [3]

The Santa Ynez area covers the valley, terrace, and foothill areas bordering San Antonio Creek and Santa Ynez River and their tributaries, from the Pacific Ocean to the headwaters of San Antonio Creek and the upper limits of agricultural land on Santa Ynez River. Between the major valleys and along the southern, eastern, and northern boundaries are included considerable areas of mountainous or steep, hilly land unsuited to agriculture. Sedimentary rocks have contributed most largely to the soil-forming materials, though more or less rock and soil material from primary or igneous sources occurs throughout the area.

Climatic conditions throughout the area are fairly uniform. Soil weathering, however, with the consequent development of soil profiles of different character, has been more or less interrupted or modified by coastal changes or earth movements and resultant environmental changes. Rather extensive areas of soil are underlain by a consolidated or semiconsolidated substratum, generally 3 or more feet in thickness, which resembles a cemented hardpan. It is improbable that such layers could develop under existing climatic conditions. Coastal movements which submerged and uplifted various parts of the area have also no doubt modified profile developments. In a number of places there are buried surfaces, indicating a general earth movement or climatic change.

Parent rock lime is present in several of the younger stream-bottom soils and in soils derived from weathering in place over calcareous sandstones. In soils of only one series has lime accumulated in abundance owing to weathering processes.

On the basis of similarity in color, degree of weathering, parent materials, and conditions under which the soils have developed, as reflected in the soil profile, the soils have been classified into soil series. On the basis of the texture of the surface soil, that is, the proportion of the different-sized particles present, the series are further divided into soil types, the unit of mapping.

On the basis of differences in profile as influenced or determined by degree and character of weathering and by parent materials the soils of the area have been classified in three groups, as follows: (1) Residual soils derived from consolidated materials; (2) soils derived from unconsolidated sedimentary or transported materials; and (3) miscellaneous materials.

[3] The Santa Ynez area adjoins the formerly surveyed Santa Maria area on the north. Since the earlier survey a number of new soil series have been established and soils which previously were included as variations of other types have been separated. A number of apparent conflicts and inconsistencies in classification and mapping of soils along the boundary between the areas occur. These are noted briefly under the discussion of the several soil types.

The residual soils developed by weathering in place on consolidated materials include soils of two groups, those derived from the harder consolidated rock formations and those derived from the softer or irregularly consolidated or cemented materials. Soils of the first subgroup in general occupy the higher ridges and elevations bordering the outer margin of the surveyed area and are generally comparatively shallow. Those of the second subgroup generally occupy low rolling ridges bordering the upper terraces. At a slight depth the soil grades into a softly consolidated substratum of the same general mineral character as the surface materials. The degree of consolidation varies, the upper part of the material generally being rather firmly cemented and the lower part merely compact or less firmly consolidated. The cemented substratum in many places has the appearance of an old hardpan which is now weathering to produce soil.

The residual soils developed on the harder consolidated rocks are grouped in the Altamont, Santa Lucia, and Zaca series.

The Altamont soils have grayish-brown, rich-brown, or dull-brown surface soils and somewhat lighter-brown subsoils. At an average depth of about 36 inches, the sandstone or shale bedrock occurs. As mapped these soils are mainly noncalcareous.

Soils of the Santa Lucia series are characterized by dull grayish-brown or dull brownish-gray surface soils over subsoils of the same or somewhat darker color. The parent bedrock of siliceous shale lies at a depth ranging from 20 to 40 inches. The soils generally give a slightly acid or neutral reaction with soiltex.

The Zaca series includes soils having dark-gray or black surface soils which are typically mildly or strongly calcareous. The subsoils consist of dull-gray or dark grayish-brown material which is highly calcareous in the deeper part and which contains an appreciable quantity of angular rock fragments. This layer is compact and similar to or heavier in texture than the surface soil, except directly over bedrock where it becomes lighter textured. At an average depth of 28 inches the subsoil rests on bedrock of calcareous sandstone or impure limestone. The bedrock ranges from firm and dense to semiconsolidated.

Residual soils developed on the less firmly consolidated rocks are placed in the Arnold, Tierra, and Chamise series.

Members of the Arnold series have rather dull brownish-gray, light brownish-gray, or light grayish-brown surface soils, slightly acid in reaction and containing a large proportion of rounded quartz sand. The upper part of the subsoils consists of slightly compact dull brownish-gray or grayish-brown material only slightly heavier textured than the surface soils. The lower subsoil layer is lighter or slightly browner in color, is friable, and grades, with slight mottling of gray and yellowish brown or rust brown, into the parent rock consisting of buff-colored softly consolidated sandstone. Bedrock lies at a depth ranging from 18 to 60 inches.

The surface soils of members of the Tierra series consist of dull grayish-brown, dark brownish-gray, or nearly black material containing considerable rounded quartz sand. The upper part of the subsoil is generally moderately compact, similar to or somewhat lighter in color than the surface soil, and intermediate in texture

between the surface soil and deeper part of the subsoil. It grades into the very compact, firm, dense, heavy-textured deeper subsoil, which rests at a depth ranging from 32 to 50 inches on soft sandstone or a cemented substratum of old sedimentary deposits. Subangular gravel occurs in the surface soils and to greater extent in the subsoils. The surface soils, especially of the lighter-textured members of the series, are distinctly acid when tested with soiltex.

The surface soils of members of the Chamise series are dull brownish gray or dark grayish brown and are generally of gravelly texture. The subsoils generally consist of two layers, the upper one consisting of dull-gray or dark brownish-gray moderately compact material of somewhat granular structure and the lower of very compact heavy-textured dark-gray or grayish-drab material which is dense and amorphous when wet but cracks into a medium cloddy structure when dry. At an average depth of 24 inches the subsoil rests on a very hard conglomeratelike substratum which continues to a depth ranging from 50 to 60 or more inches, where it is underlain by less firmly consolidated materials. The soil shows no lime present when tested with dilute acid. The soils of this series are derived largely from the weathering of what appears to have been an older extremely thick hardpan development.

The soils developed on unconsolidated sedimentary or transported deposits occupy the river flood plains and adjacent terraces. They represent various stages of weathering, as is evidenced by the degree of compaction and texture and structure of the surface soil and subsoil. They may be derived from either stream-laid or marine sediments. Depending on the degree of weathering that has occurred since deposition, the soils of this group are further subdivided into the more mature soils developed on old valley-filling deposits, immature soils developed on young valley-filling deposits, and unweathered recent-alluvial soils.

The Tangair, Cachuma, Ballard, Santa Ynez, and Montezuma soils are recognized as representative of more mature development in the soils developed on unconsolidated sedimentary or transported materials.

The surface soils of the Tangair soils are medium or dull brownish gray or dull grayish brown. They contain much rounded quartz sand and when dry and uncultivated are somewhat cemented or puddled. The subsoil occurs in two layers, the upper one consisting of light brownish-gray or light-gray slightly compact material, which in the lower part is somewhat mottled with gray or yellowish-brown iron stains, and the lower one being pale-yellow or yellowish-gray moderately compact material containing a variable quantity of iron concretions ranging from less than one-half inch to 5 inches in diameter. The concretions are of different forms but few are spherical. This layer is also mottled with rust brown or yellowish brown from partly formed concretions and the lower part of it is in many places heavier in texture than the upper part. At a depth ranging from 6 to 10 feet there is a substratum of softly cemented sandstone similar to that under the Arnold soils or, in a few places, of shale bedrock.

The soils of the Cachuma series are characterized by rich-brown or light reddish-brown surface soils of low organic-matter content, and

they are firm and baked when dry. The upper part of the subsoil is light reddish-brown, rich-brown, or chocolate-brown slightly compact material of granular structure and containing numerous root cavities. The deeper part of the subsoil is reddish-brown or chocolate-brown dense waxy clay which has a pronounced glaze from colloidal accumulation on the cracks or partings. The lowest part of the subsoil consists of dense, extremely compact gravelly material. Light-colored siliceous shale gravel in this layer give it a brownish-gray appearance, though the soil material is generally of reddish-brown or chocolate tint.

The surface soils of members of the Ballard series are medium brown, light reddish brown, or rich brown in color, when air-dry appearing rather grayish brown. The subsoil to a depth ranging from 30 to 45 inches consists of friable, granular, pale reddish-brown or rich-brown material. This layer is directly underlain by a very compact dull reddish-brown or dull-brown gravelly deposit.

The Santa Ynez soils have very dark dull-brown, dark grayish-brown, or dark brownish-gray surface soils. The subsoils show three horizons, distinct in texture and structure. The upper horizon consists of slightly compact dark grayish-brown or dark-gray material which appears black when wet and which is of similar or only slightly heavier texture than the surface soil. The second horizon consists of light-gray or brownish-gray slightly compact material which is mealy in structure when broken down. This material is somewhat mottled with gray and yellowish brown. The deeper horizon, which occurs at a depth ranging from 28 to 36 inches, consists of grayish-drab stiff waxy clay of predominantly colloidal character. Below an average depth of about 52 inches there is a light brownish-gray or yellowish-gray dense gravelly deposit somewhat lighter in texture than the overlying clay. This material, as well as that of the overlying layer, is amorphous.

The surface soils of members of the Montezuma series are dark gray or black and are well supplied with humus. The upper part of the subsoil is very compact, is of jointed or small cloddy structure, and is similar to or slightly grayer than the surface soil. At an average depth of 34 inches the subsoil grades abruptly into somewhat grayer material, and in seams and cracks there are soft lime aggregates. This horizon is in turn underlain by less compact noncalcareous light brownish-gray material.

The younger or immaturely weathered soils developed on unconsolidated sedimentary or transported material include members of the Marina, Botella, and Salinas series.

The Marina soils have light-brown, brown, or grayish-brown surface soils over subsoils of similar or slightly lighter color. These soils developed on immaturely weathered terrace deposits, and little or no compaction or modification is apparent in the subsoil. The soils are light textured and have been somewhat modified by wind.

The soils of the Botella series have very dark dull-brown, very dark grayish-brown, dark-gray, or nearly black surface soils moderately well supplied with organic matter. The subsoils are of similar or of slightly lighter or browner color. The lighter color is more pronounced with depth. At an average depth of about 20 inches the subsoil becomes somewhat compact and in many places slightly

heavier textured. It continues to a depth ranging from 45 to 60 inches, where it is underlain by more friable material which in general is somewhat stratified.

The Salinas series includes soils with very dark dull-brown, dark grayish-brown, or nearly black surface soils, slightly compact upper subsoil layers of similar color, and dull-gray or brownish-gray moderately compact highly calcareous lower subsoil layers. The deposits giving rise to these soils are of moderate age, and weathering has resulted in a slight compaction and lime accumulation in the subsoil.

In the group of unweathered recent-alluvial soils have been placed members of the Metz, Yolo, Elder, Agueda, and Laguna series.

The surface soils of members of the Metz series are light brown, slightly yellowish brown, or grayish brown in color and friable in consistence. The subsoils are of similar or slightly lighter color but are stratified. Both surface soils and subsoils range from mildly to rather highly calcareous. The soils are of recent deposition and have suffered no noticeable modification from weathering.

The Yolo soils are characterized by brown, rather dark-brown, or light grayish-brown surface soils over subsoils of similar color and of stratified structure. Typically both surface soils and subsoils are noncalcareous. The material giving rise to these soils is of recent deposition and is permeable and friable to a depth of 6 or more feet.

The Elder series includes soils having dark dull grayish-brown or dark-gray surface soils and dull brownish-gray or dark dull grayish-brown subsoils. The soils are moderately well supplied with organic matter, absorb water readily, and retain it well under cultivation. They are typically noncalcareous and uniform in profile to a depth of 6 or more feet, except for differences in texture owing to stratification. These soils are of recent alluvial origin and include material from a wide range of rocks, chiefly of sedimentary origin.

The Agueda series includes soils having dark dull grayish-brown, dark brownish-gray, or nearly black calcareous surface soils over calcareous subsoils of similar or of somewhat grayer color and of stratified structure. These soils absorb and retain water well under cultivation, owing to their fair content of organic matter. They are derived from a variety of recently deposited rocks, chiefly sedimentary.

The surface soils of members of the Laguna series are dull gray, light gray, or light brownish gray, and the subsoils are of similar or grayer color. These soils are derived largely from light-colored siliceous shales and contain no lime above a depth of 6 feet.

Miscellaneous materials include peat, rough broken land, coastal beach and dune sand, and river wash. These soils are nonagricultural in their present condition, with the exception of peat which consists of organic deposits mixed with some mineral matter. In this area the vegetable matter in peat soils is from a number of sources and is in various stages of decomposition.

Table 2 shows mechanical analyses and moisture equivalents for some of the soils of the area.

TABLE 2.—*Mechanical analyses and moisture equivalents of certain soils of the Santa Ynez area, Calif.*

Soil type and sample No.	Depth	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay (0.005–0.001 mm.)	Colloid (<0.001 mm.)	Total clay	Moisture equivalent
Metz very fine sandy loam:	*Inches*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
577131	0–18	0.0	0.1	0.4	11.9	65.7	10.6	3.0	8.2	11.2	19.5
577132	18–45	.1	.3	1.1	11.5	80.4	3.6	.8	2.9	3.7	12.5
577133	45–72	.3	.1	3.4	44.5	47.7	1.6	.0	2.9	2.9	6.7
Laguna clay loam:											
577142	0–10	.2	.5	1.3	12.5	34.3	21.5	11.5	18.1	29.6	31.7
577143	10–72	.2	.6	.7	6.5	25.1	28.4	17.9	21.3	39.2	41.9
Yolo fine sandy loam:											
577183	0–12	1.2	4.0	4.8	14.8	36.0	19.7	6.4	12.9	19.3	20.4
577184	12–72	.7	2.1	3.8	8.4	35.2	25.1	9.6	15.3	24.9	25.5
Elder fine sandy loam:											
577138	0–14	.8	1.5	2.5	26.9	36.8	11.3	11.7	8.3	20.0	------
577139	14–74	.7	1.6	3.2	33.3	32.8	8.9	7.1	13.1	20.2	------
Agueda sandy clay:											
577169	0–12	1.1	1.9	6.7	19.0	17.5	18.3	11.1	24.8	35.9	34.0
577170	12–72	.4	1.4	2.2	6.7	17.3	23.7	16.5	31.5	48.0	42.5
Agueda clay adobe:											
577179	0–12	.2	.7	.9	6.1	22.9	35.0	3.4	31.3	34.7	41.3
577180	12–72	.1	.6	.6	4.2	15.4	35.2	.0	43.0	43.0	47.7
Salinas clay:											
577116	0–10	.6	1.0	1.1	5.5	31.5	21.4	18.5	19.4	37.9	32.7
577117	10–40	.2	.4	.6	4.6	28.0	22.8	19.6	23.8	43.4	33.4
577118	40–76	1.4	1.4	1.6	6.5	33.5	20.3	13.3	22.0	35.3	30.5
Botella loam:											
5771109	0– 8	.5	1.7	2.7	18.4	35.9	18.0	8.3	15.1	23.4	23.0
5771110	8–28	.4	1.1	3.5	18.9	34.5	15.9	7.9	18.3	26.2	23.3
5771111	28–52	.7	2.5	3.3	20.0	34.4	14.5	6.4	18.8	25.2	23.2
5771112	52–80	.8	2.4	6.5	16.6	39.0	11.5	6.9	14.6	21.5	20.2
Botella clay:											
577160	0–12	.0	.6	.5	2.1	28.4	31.1	19.5	18.2	37.7	35.1
577161	12–50	.0	.2	.2	1.0	26.2	24.3	19.1	28.7	47.8	41.9
577162	50–80	.0	.3	.2	1.4	34.7	23.1	15.0	25.5	40.5	38.2
Ballard fine sandy loam:											
577193	0– 9	1.6	3.3	9.8	19.8	39.4	12.9	1.3	11.9	13.2	14.5
577194	9–23	1.8	5.6	8.6	20.4	37.3	12.3	7.9	5.6	13.5	13.7
577195	23–36	2.0	7.0	10.1	21.7	33.5	13.9	6.1	6.2	12.3	12.7
577196	36–80	2.9	4.5	14.8	24.7	30.1	12.0	5.8	5.4	11.2	12.2
Cachuma fine sandy loam:											
5771123	0– 9	2.0	2.1	3.8	15.8	42.2	20.0	8.1	5.5	13.6	17.8
5771124	9–18	1.2	3.0	3.1	15.5	43.0	18.6	8.2	7.2	15.4	16.9
5771125	18–32	4.7	5.9	4.7	12.6	16.9	10.7	16.4	29.0	45.4	34.4
5771126	32+	13.2	19.2	11.9	14.3	10.0	6.0	7.9	18.3	26.2	30.0
Santa Ynez gravelly fine sandy loam:											
577101	0– 7	4.5	5.1	3.0	9.8	45.1	13.8	6.4	11.6	18.0	21.8
577102	7–21	4.2	4.2	4.3	10.0	45.6	12.3	6.4	12.7	19.1	21.0
577103	21–30	3.3	3.1	3.9	10.1	53.6	10.6	5.4	9.3	14.7	18.7
577104	30–52	4.2	3.6	1.9	7.4	21.2	8.6	7.0	46.3	53.3	59.6
577105	52–78	5.3	2.1	2.8	13.6	34.0	7.5	4.8	32.0	36.8	35.1
Montezuma clay:											
577190	0–12	.4	.9	.6	3.3	24.2	26.1	19.4	25.2	44.6	38.4
577191	12–42	.8	.6	.5	2.3	22.1	27.8	24.1	22.2	46.3	34.4
577192	42–68	.3	1.1	.8	2.6	21.2	25.1	19.1	30.1	49.2	42.0
Arnold fine sandy loam:											
577173	0–10	.2	1.0	15.8	25.0	29.0	15.4	8.3	5.1	13.4	16.0
577174	10–24	.3	.8	17.7	22.5	23.1	20.0	11.6	5.0	16.6	14.0
577175	24–30	.2	2.2	16.2	24.2	28.6	18.9	6.1	2.9	9.0	12.9
Chamise gravelly fine sandy loam:											
577119	0–10	5.5	7.9	4.8	13.1	40.8	10.8	6.3	10.7	17.0	21.3
577120	10–24	6.7	5.9	6.9	15.1	37.9	9.7	7.0	10.1	17.1	19.6
577121	24–32	3.8	4.2	2.6	9.3	25.1	6.7	2.0	46.3	48.3	56.3
Tierra fine sandy loam:											
577147	0–14	1.4	3.7	5.0	12.8	43.4	16.8	6.9	10.0	16.9	18.7
577148	14–40	.7	3.0	3.9	10.2	36.0	12.3	6.7	26.6	33.3	31.2
577149	40+	2.5	5.2	11.2	18.3	41.1	11.5	5.3	4.8	10.1	12.8
Altamont fine sandy loam:											
577185	0–8	1.1	1.7	1.3	41.9	34.1	8.4	5.3	6.3	11.6	12.7
577186	8–20	.7	1.2	1.7	40.2	33.8	8.9	6.4	7.0	13.4	14.6
577187	20–36	.6	1.2	1.3	38.9	35.9	8.5	6.4	7.3	13.7	14.4
Zaca clay:											
577155	0–10	.5	.8	.6	4.5	26.0	29.1	16.7	21.2	37.9	33.7
577156	10–30	.1	.5	.5	2.7	20.1	19.5	25.4	31.8	57.2	44.6
577157	30–38	.1	.7	1.1	3.5	20.9	22.9	19.3	32.2	51.5	48.2
Santa Lucia clay:											
577176	0–8	.5	1.1	1.1	2.3	9.3	31.9	34.0	20.0	54.0	57.8
577177	8–28	.7	.6	.5	.8	2.6	19.4	27.0	49.1	76.1	66.1
577178	28–36	.5	.9	.6	1.2	2.2	14.2	25.8	55.3	81.1	63.9

In the following pages of this report the soils are described in full and their agricultural importance is discussed. Their distribution is shown on the accompanying soil map, and their acreage and proportionate extent are given in Table 3.

TABLE 3.—*Acreage and proportionate extent of the soils mapped in the Santa Ynez area, Calif.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Metz silty clay loam	6,912		Altamont fine sandy loam	2,560	.5
Heavy-textured phase	320	1.5	Altamont clay	4,480	
Poorly drained phase	320		Dark heavy phase	3,136	1.5
Metz very fine sandy loam	9,664		Tierra fine sandy loam	14,464	
Heavy-textured phase	1,600	2.3	Light-colored phase	1,280	3.3
Metz fine sand	3,136	.6	Tierra clay loam	2,816	.6
Ballard fine sandy loam	10,880		Arnold fine sandy loam	3,008	.6
Friable-subsoil phase	3,584	3.0	Arnold sand	24,256	5.0
Botella loam	15,232	3.2	Santa Lucia clay	10,944	
Botella fine sandy loam	1,792	.4	Gravelly phase	768	2.5
Botella sandy loam	3,008		Montezuma clay	1,152	.2
Poorly drained phase	960	.8	Santa Ynez gravelly fine sandy loam	9,472	2.0
Botella clay	5,376	1.1	Laguna clay loam	1,088	.2
Salinas gravelly loam	4,480	.9	Laguna fine sand	1,600	.3
Salinas gravelly clay loam	3,136	.6	Yolo fine sandy loam	3,328	.7
Salinas clay	2,688	.6	Yolo fine sand	4,416	.9
Elder fine sandy loam	5,184		Marina sand	32,000	6.6
Gravelly phase	11,136	3.4	Tangair sand	8,960	
Elder gravelly clay	1,216	.3	Heavy-subsoil phase	5,696	3.1
Elder sandy loam	9,536		Chamise gravelly fine sandy loam	15,360	
Gravelly phase	960	2.2	Light-colored phase	4,352	4.1
Agueda sandy clay	2,432		Peat	512	.1
Heavy phase	320	.6	Rough broken land	184,064	38.2
Agueda sandy clay loam	768	.2	Coastal beach and dune sand	11,648	2.4
Agueda clay adobe	1,408	.3	River wash	4,544	.9
Cachuma gravelly fine sandy loam	5,760	1.2			
Cachuma fine sandy loam	832	.2			
Zaca clay	14,016	2.9	Total	482,560	

METZ SILTY CLAY LOAM

To a depth ranging from 10 to 18 inches Metz silty clay loam consists of pale yellowish-brown or light grayish-brown smooth mellow silty clay loam. The subsoil is similar to the surface soil in color but is generally somewhat stratified in the lower part. The texture ranges from silty clay loam or clay to very fine sandy loam. Both surface soil and subsoil are distinctly calcareous. This soil is deep, mellow, and friable, and all forms of plant life flourish on it. It absorbs moisture readily and when cultivated retains it well, though it gives it up readily to plant roots.

A few included small patches, such as those in Happy Canyon in the eastern part of the surveyed area, a few bordering Santa Ynez River to the south of the Santa Rita Hills, and one 2½ miles south of Buellton, are of lighter texture than typical. In a patch of this soil in the Los Alamos Valley 1 mile east of Careaga the surface soil is calcareous and both surface soil and subsoil are gray. Had this body been more extensive it would have been mapped in the Panoche series.

A large typical area of Metz silty clay loam occurs at Lompoc. Smaller somewhat isolated tracts are also in this vicinity and to the east of Lompoc in the Santa Ynez River bottom between the Santa Rita Hills and the mountains to the south. One or two small areas occur in the river bottom to the west of Buellton.

Tracts of Metz silty clay loam are smooth, almost level, or gently sloping. Drainage is well developed, and areas are seldom if ever overflowed.

Metz silty clay loam is one of the most highly developed and agriculturally important soils in the area. The leading crops grown on it are flower seeds, beans, sugar beets, vegetables, mustard, and grains, but some acreage is devoted to practically all crops suited to the region. The growing of flower seeds is becoming increasingly important. Yields and quality are good. The yields of other crops average from 5 to 10 per cent higher than on Metz very fine sandy loam. Lettuce and cauliflower are the principal vegetables produced, and yields of 200 or 250 crates to the acre are obtained.

When sold alone this soil commands from $500 to $700 an acre. Unirrigrated areas some distance from shipping points can be had for less.

This soil is generally well farmed and maintained in a high state of productivity. Under intensive cropping, a rotation should be followed which will add organic matter to the soil. Vegetable gardening, the production of flower seeds, and walnut production offer opportunities for further development of the soil.

Metz silty clay loam, heavy-textured phase.—To a depth ranging from 10 to 15 inches, the surface soil of Metz silty clay loam, heavy-textured phase, consists of light grayish-brown or rather dull grayish-brown silty clay or clay. The subsoil is light grayish-brown somewhat stratified silt loam or clay and locally is slightly mottled owing to poor subdrainage. Both surface soil and subsoil are highly calcareous. Because of a higher clay content this soil is not so absorptive of moisture or easy of cultivation as the lighter-textured soils of the Metz series.

This soil is not extensive. With the exception of one very small area 4 miles west of Buellton, it does not occur outside the lower Lompoc Valley. One of the largest areas is 2 miles west of Lompoc and another is at Artesia School.

The soil is of mixed origin and occupies low terraces or alluvial benches only slightly above stream overflow. Areas are smooth, with gentle slopes, and drainage is good. The land is all under cultivation. It is well suited to sugar beets, which yield 20 or more tons to the acre where the fields are free from pests. Beans, flower seeds, mustard, grains, and vegetables also give heavy yields. The soil should return good yields of artichokes.

The heavy-textured phase of Metz silty clay loam is valued about the same as the typical soil and is utilized and improved like other soils of the Metz series.

Metz silty clay loam, poorly drained phase.—The surface soil of the poorly drained phase of Metz silty clay loam consists of light-brown or grayish-brown silty friable clay loam or silty clay. It is underlain at a depth of 10 or 15 inches by the grayish-brown silty clay loam or clay loam subsoil which is underlain at a depth ranging from 20 to 40 inches by slightly stratified dark grayish-brown or dark-gray silty clay loam, silt loam, or clay loam mottled gray and yellow. Lime is abundant in both surface soil and subsoil. The subsoil is continually moist, and in the rainy season the water table stands 3 or 4 feet from the surface.

The largest and most typical area of poorly drained Metz silty clay loam occurs near the mouth of Santa Ynez River. A small area is 2 miles west of Artesia School. Tracts are smooth and flat and occupy positions somewhat lower than the surrounding soils. Surface drainage is fair, though subdrainage is poor. The land is in need of artificial drainage.

The soil is used as pasture land.

METZ VERY FINE SANDY LOAM

The surface soil of Metz very fine sandy loam, which is from 10 to 20 inches thick, consists of light-brown, light yellowish-brown, or light grayish-brown calcareous very fine sandy loam of low silt and clay content. The subsoil is composed of sediments similar in color to the surface soil but stratified in structure. In general the texture ranges from fine sandy loam to very fine sand. The subsoil is calcareous and shows no evidence of lime accumulation. The soil absorbs moisture readily and is friable and permeable to a great depth.

This soil occurs entirely on the bottom lands of Santa Ynez River and its tributaries. Important areas border the river east, west, and north of Lompoc. Many smaller areas are east of the Lompoc Valley as far as the eastern boundary of the surveyed area.

Metz very fine sandy loam is a recent-alluvial soil of mixed origin. Tracts are smooth and gently sloping and are well suited to all cultural practices and to irrigation. Drainage is excellent, and the soil is rarely overflowed. About 90 per cent of the land is under cultivation, and practically all crops suited to local climatic conditions are grown. Fruits and nuts offer opportunity for greater development in localities sheltered from the wind. Alfalfa is produced largely in connection with dairying, and under irrigation yields 5 or 6 tons to the acre. Yields of beans average about 15 sacks to the acre under good cultural practices. Red mustard yields from 12 to 18 sacks, and sugar beets from 18 to 22 tons under irrigation. Cauliflower, beets, carrots, lettuce, and a number of other vegetables give excellent yields.

When well improved and convenient to market, this soil is held at prices between $400 and $600 an acre. Less accessible areas sell for $200 or $300 an acre or less.

Metz very fine sandy loam is a highly productive soil and is generally well farmed. Under intensive farming methods, care must be exercised to maintain the humus content. Phosphatic fertilizers increase yields of grain and mustard, and potash generally improves yields of sugar beets, vegetables, and fruits. Nitrogen is essential for successful production of all crops and can best be supplied by turning under leguminous cover crops. The depth of plowing should be changed from year to year, and a definite system of rotation, including a leguminous crop every second or third year, should be followed. It seems that more of the soil might be used for vegetable production.

Metz very fine sandy loam, heavy-textured phase.—The surface soil of the heavy-textured phase of Metz very fine sandy loam consists of light-brown or light grayish-brown very fine sandy loam showing a faint tint of yellow. It is of slightly higher silt and clay

content than typical Metz very fine sandy loam. This layer is underlain at a depth ranging from 10 to 20 inches by the subsoil, which continues to a depth of 6 or more feet and consists of stratified loose mellow very fine sandy loam, loam, or silt loam. Both surface soil and subsoil are mildly or moderately calcareous. The soil is easily tilled and has high water-holding capacity and high average fertility. It is suited to a wide range of crops.

A typical and very uniform area occupies the flat between Buellton and Solvang. Several smaller areas are near and to the east of the place where Salsipuedes Creek empties into Santa Ynez River.

The heavy-textured phase of Metz very fine sandy loam is important agriculturally. The smooth, gently sloping land surface and good drainage adapt it to irrigation and cultural operations.

Practically all the land is under cultivation. Yields are as good as or better than on typical Metz very fine sandy loam, and the soil is valued as highly as any soil in the area.

The growing of vegetables, flower seeds, fruits, and nuts could well be extended. Suggestions given for the improvement of typical Metz very fine sandy loam are equally applicable to the phase.

METZ FINE SAND

The surface soil of Metz fine sand to a depth ranging from 10 to 20 inches consists of loose friable pale-yellowish or light grayish-brown fine sand. The subsoil is pale or light grayish-brown friable stratified material ranging in texture from fine sand to silt loam but in general is composed largely of sandy-textured materials. Both surface soil and subsoil are calcareous, the lime being uniformly distributed and showing no tendency toward accumulation. This soil to a depth of 6 or more feet is readily permeable to plant roots and water. Under cultivation moisture is well retained, though the land dries out quickly when not cultivated.

A few small included areas of gravelly texture are indicated on the map by gravel symbols. Such areas are slightly less valuable for agriculture than the typical soil, because of the greater porosity of the material, especially the subsoil which is very gravelly and coarse textured in places. Most of the gravelly areas border Santa Ynez River in the eastern part of the surveyed area. Two such areas occur south and west of Buellton.

Several areas of typical Metz fine sand are in the vicinity of Buellton, and many patches border Santa Ynez River from Buellton to its mouth. The soil does not occur outside the Santa Ynez River bottom.

Tracts of Metz fine sand are generally smooth, except where broken by gullies formed by varying currents in time of overflow. A part of the land is subject to periodic overflow, but most of it is overflowed only during excessively high water. Areas are well drained and suited to irrigation and cultural practices.

With the exception of about 30 per cent of this soil, which occupies the lower-lying areas, it is all under cultivation to alfalfa, beans, mustard, vegetables, grain crops, and less important crops. The lower-lying areas are covered with willows, sycamores, and other trees, brush, or grass and are used for grazing. Crop yields are less than on Metz very fine sandy loam.

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When sold alone Metz fine sand commands from $200 to $550 an acre. When sold in association with higher areas, the lower-lying tracts subject to periodic overflow depress the sale value. The soil can be improved somewhat in moisture-holding capacity and fertility by the addition of organic matter.

BALLARD FINE SANDY LOAM

Ballard fine sandy loam to a depth of 8 or 10 inches consists of brown, light reddish-brown, or pale reddish-brown fine sandy loam. The soil is friable and easily tilled when moist but becomes hard and intractable on drying. The upper part of the subsoil, to a depth ranging from 20 to 26 inches, consists of light reddish-brown or dull reddish-brown slightly compact fine sandy loam. This material is firm, though readily penetrated by plant roots, and breaks up readily to a finely granular condition. The lower part of the subsoil, to a depth between 30 and 48 inches, consists of light reddish-brown, compact, slightly cemented loam or very fine sandy loam. Root cavities are numerous, and the material is easily crumbled to a granular structure. This layer grades very abruptly into very compact and partly cemented gravelly fine sandy loam or loam. Most of the soil aggregates in this layer are glazed with reddish-brown colloidal material. This soil is differentiated from the related Cachuma soils mainly on the basis of the absence of the heavy clay horizon over the gravelly substratum.

As mapped this soil includes some tracts of very fine sandy loam bordering Santa Ynez River in the eastern end of the surveyed area and an area of clay loam 2 miles southwest of Solvang. In extensive areas, indicated on the soil map by gravel symbols, occurring on the mesa east of Ballard, bordering La Zaca Creek, Canada del Comasa, and Santa Ynez River and some of its tributaries the surface soil and upper part of the subsoil as well as the deeper materials contain gravel in sufficient quantity to affect the texture of the soil. Tracts occurring on alluvial terraces and fan slopes bordering Santa Ynez River in the eastern part of the area and shown on the soil map by stone symbols do not differ essentially in profile from the gravelly areas, but the surface soil and subsoil contain a great many stones ranging in size from large cobbles to bowlders from 12 to 18 inches in diameter. The stone is also present to a greater or less extent in the substratum.

Typical tracts of Ballard fine sandy loam border Santa Ynez River from the eastern boundary of the surveyed area as far as Buellton. The soil is most extensive on the terraces on which Solvang is situated and on terraces occupying similar positions east and west of that town. They are smooth and gently sloping or in places gently undulating, and locally are dissected by narrow steep-sided drainage ways. Surface drainage is good and subdrainage is normally sufficient, though following unusually heavy rains water stands on some of the lower areas.

Under virgin conditions scattered oaks with intervening grassy areas give this soil a parklike appearance. About 85 per cent of it is under cultivation to beans, grain, vegetables, and fruit. Barley yields from 12 to 20 sacks to the acre, and wheat and oats give equally satisfactory yields. Beans, of both the baby Lima and small white

varieties, yield from 8 to 12 sacks to the acre. Under irrigation, vegetables and fruits are successfully produced, and the land is highly valued for agriculture. When sold alone it commands from $125 to $200 an acre.

With the exception of the stony areas none of which is under cultivation and which have little potential value, Ballard fine sandy loam is a productive soil and can be maintained in good condition by crop rotation, the addition of organic matter, and care to prevent puddling or the development of a plow sole.

Ballard fine sandy loam, friable-subsoil phase.—To a depth ranging from 7 to 12 inches, the friable-subsoil phase of Ballard fine sandy loam consists of loose friable light-brown or light rich-brown fine sandy loam. This is underlain to a depth ranging from 24 to 36 inches by the upper part of the subsoil, which consists of compact light-brown fine sandy loam containing a great number of small root cavities which promote aeration and movement of soil moisture. The next lower part of the subsoil, to a depth between 48 and 58 inches, is compact light-brown fine sandy loam or loam. Below this the lowest part of the subsoil becomes less compact, generally lighter in texture or somewhat stratified in structure, and lighter in color, in most places showing a shade of yellow. Some included patches in the eastern part of the surveyed area are of very fine sandy loam texture, and two small areas bordering Santa Ynez River south of Santa Ynez are of gravelly texture.

This soil is most extensive in the extreme eastern part of the area where several tracts occur along Santa Ynez River. Other areas border the river elsewhere, and tracts occur on low ridges or benches in Lompoc Valley west of Lompoc. Areas are in general smooth and gently sloping. They occupy low terraces or alluvial-fan slopes where drainage is well developed. The land is well suited to irrigation where water is available.

Oaks, brush, and grass cover the virgin soil. About 30 per cent of the land is now under cultivation and returns profitable yields of beans, mustard, vegetables, and barley. Mustard yields from eight to twelve 100-pound sacks of seed to the acre, or more in good seasons. Beans yield about the same as mustard, and barley yields from 10 to 20 sacks to the acre.

Ballard fine sandy loam, friable-subsoil phase, is seldom sold alone, but it is valued highly for agriculture. It occurs largely in association with recent-alluvial soils but is valued slightly less than such soils.

BOTELLA LOAM

Botella loam to a depth ranging from 7 to 9 inches consists of very dark dull grayish-brown, dark brownish-gray, or nearly black mellow friable loam. Unless cultivated the surface soil becomes crusted or baked on drying. The subsoil consists of two layers of different compaction and texture, evidently resulting from translocation of soil material from the surface downward by weathering agencies. The upper layer to a depth ranging from 24 to 30 inches consists of very dark dull grayish-brown slightly compact fine sandy loam or loam which grades into more compact dull grayish-brown heavy fine sandy loam or loam. The parent material of dull grayish-brown or brownish-gray loam or fine sandy loam lies at a

depth ranging from 48 to 54 inches. The lower subsoil layer is generally somewhat stratified. Roots pentrate the soil readily and on decay leave many small rounded cavities, the greatest number of which occur in the upper subsoil layer. Few or no root cavities appear in the lower part of the parent material.

Botella loam as mapped includes a few small areas of gravelly texture which are shown on the soil map by gravel symbols. One such area is 2 miles west of Casmalia, another is 5 miles south of Santa Rita, a rather large one is in the canyon of La Zaca Creek, and a patch is near Buellton.

The typical soil occurs chiefly in the Los Alamos Valley, in several of the larger valleys north of that valley, and in the vicinity of Casmalia and along the coast west of that place. Other areas are in San Julian Valley, in numerous other valleys, and on alluvial-fan slopes.

The soil generally occurs on smooth, gently sloping alluvial fans or low alluvial terraces little marked by erosion. It represents an immaturely weathered alluvial deposit of mixed origin. Drainage of surface soil and subsoil is excellent.

Eighty per cent or more of the soil is under cultivation. Under virgin conditions it was grass covered, but numerous oak trees were scattered over it. The cultivated crops are barley, beans, mustard, peas, and other crops common to the region. Under favorable conditions beans yield from 9 to 12 or more sacks to the acre, and yields of 20 or 25 sacks have been reported. Red mustard ordinarily yields from eight to twelve 100-pound sacks to the acre, and yields of 16 or 18 sacks have been obtained. Other crops yield equally well, and the soil is regarded very highly for crop production.

When sold alone this soil commands from $150 to $300 an acre. Higher prices are asked for some areas which are well improved and close to market, whereas less accessible areas can be had for less money.

Botella loam is generally well farmed and is in a good state of productivity. It is recommended that bean straw be returned to the land and other means taken to build up the supply of organic matter. A rotation to include one or more intertilled crops will keep this soil in good physical condition.

BOTELLA FINE SANDY LOAM

The surface soil of Botella fine sandy loam, which is from 8 to 12 inches thick, consists of dull dark brownish-gray or nearly black fine sandy loam containing considerable organic matter and a large proportion of very fine sand. The subsoil to a depth ranging from 40 to 60 inches is dull grayish-brown or dark brownish-gray moderately compact fine sandy loam or loamy very fine sand. It is readily penetrated by roots and contains numerous cavities left from their decay. The lower part of the subsoil, to a depth of 6 or more feet, consists of light grayish-brown or brownish-gray slightly compact and commonly stratified material of fine sandy loam or loam texture.

This soil is rather inextensive. One of the largest areas occurs in Purisima Canyon north of Lompoc, three small areas are near the mouth of that canyon, and small areas are in numerous small valleys, particularly in the vicinity of Casmalia.

Except where broken by narrow steep-sided drainage ways the land has a smooth, gently sloping relief, and drainage is well developed. The soil represents an immaturely weathered alluvial deposit of mixed origin.

About 85 per cent of the Botella fine sandy loam is under cultivation. Barley, beans, mustard, and other crops are produced. Crop yields and land values are about the same as for Botella sandy loam.

BOTELLA SANDY LOAM

Botella sandy loam to a depth ranging from 8 to 12 inches consists of very dark dull-brown or dark grayish-brown mellow sandy loam high in fine sand and low in silt and clay and containing a fair proportion of organic matter. Unless cultivated the surface soil crusts badly. The subsoil, which shows slight evidence of weathering, occurs in two layers. The upper one, to a depth ranging from 18 to 24 inches, consists of very dark dull-brown or dark grayish-brown slightly compact fine sand or fine sandy loam; the second is more compact and consists of dark-brown or dull grayish-brown fine sand or fine sandy loam. The parent material is brownish-gray fine sand or fine sandy loam, somewhat stratified and firm though not greatly compacted. Included in mapping are two areas of gravelly texture, the largest occurring near the head of Foxen Canyon and the other lying 3 miles north of Solvang.

Typical areas of this soil occur in a great number of the smaller valleys to the north of Los Alamos Valley. Some of the largest tracts are in Solomon and Careaga Canyons, and smaller areas are north of Los Alamos and at other places bordering Los Alamos Valley as far as Harriston.

A small area of this soil adjoins a small area mapped as Yolo sandy loam in the Santa Maria area. Another, occurring in a locality in which the narrow valley soil areas were not differentiated owing to minor extent and significance, adjoins Madera loam.

This soil occupies stream bottoms and low benches above overflow of the streams. It is smooth and well suited to cultivation, except where deeply cut by drainage ways. Drainage of surface soil and subsoil is well established.

About 90 per cent of the land is under cultivation, principally to beans, mustard, alfalfa, and barley. Alfalfa is grown largely in connection with the dairy industry and is used principally for pasture. A good stand capable of yielding 5 or 6 tons of hay to the acre is maintained. Beans and mustard yield from 8 to 15 sacks to the acre, with an average of about 10 sacks.

When sold alone this soil is held at a price between $150 and $200 an acre. It is productive and generally well farmed. The practice of rotation, with the turning under of cover crops and careful tillage, will aid in maintaining productivity.

Botella sandy loam, poorly drained phase.—The poorly drained phase of Botella sandy loam is characterized by a 10 or 12 inch surface layer of very dark dull grayish-brown fine sandy loam or sandy loam, over an upper subsoil layer of moderately compact dark grayish-brown or dark brownish-gray fine sandy loam or loam. At a depth ranging from 28 to 36 inches the subsoil becomes more compact and consists of dark-gray loam, sandy loam, or clay loam mot-

tled with gray, yellow, and rust brown. This material continues to a depth of 6 or more feet with little or no change except that due to stratification.

Only three areas of this phase of soil, the largest one-half mile west of Harriston, another 1 mile northeast of Los Alamos, and the third in Careaga Canyon, are mapped. The land is smooth and very gently sloping or flat, and drainage is poorly developed.

This poorly drained soil is covered with grass and, in the more moist areas, with water-loving sedges. It is used only as pasture land or for wild hay. It is not valued highly and has a depressing influence on the sale price of adjoining cultivated lands.

BOTELLA CLAY

The surface soil of Botella clay to a depth ranging from 8 to 12 inches consists of very dark dull-brown, dark grayish-brown, or brownish-gray clay. The subsoil to a depth between 48 and 56 inches is moderately compact very dark grayish-brown or nearly black firm dense clay with fairly well-developed cleavage planes resulting in a rough columnar structure. The faces of the joints are coated with a colloidal deposition. The lower part of the subsoil to a depth of 72 or more inches is dull brownish-gray slightly compact but granular clay loam or clay. The surface soil is moderately well supplied with organic matter. Unless cultivated it bakes or crusts badly following heavy rains. A few small gravelly areas occurring in the lower San Julian Valley have been included in mapping.

This soil is rather extensive. A number of areas are in the San Julian Valley, in many of the small valleys to the north of Lompoc, and in the vicinity of Casmalia. Other small areas occur in association with other soils in stream bottoms and on alluvial fans. The soil has a fan or terracelike relief and generally lies several feet above stream overflow. Drainage is good, and the land is well suited to irrigation where water is available.

About 60 per cent of the land is under cultivation. Small cultivated areas are usually used for pasture in connection with adjoining soils. Barley, beans, mustard, and many other crops are grown, and crop yields are similar to those on Botella loam.

The soil is not sold alone but is valued highly for agricultural purposes. Suggestions given for the improvement and utilization of and crop yields are similar to those on Botella loam.

SALINAS GRAVELLY LOAM

Salinas gravelly loam to a depth ranging from 8 to 12 inches consists of very dark dull grayish-brown or dark brownish-gray gravelly loam. Materials leached from the surface soil have accumulated in the subsoil during the process of weathering, making the layer moderately compact very dark dull brownish-gray or dark dull grayish-brown gravelly fine sandy loam or loam. At a depth ranging from 40 to 52 inches this layer is underlain by slightly compact lighter-colored brownish-gray or dull grayish-brown calcareous stratified material ranging in texture from sandy loam to clay loam. Gravel may or may not be present in this horizon. The surface soil absorbs water readily and retains it well under cultivation. The soil

as a rule is not excessively gravelly, though enough gravel is present to interfere somewhat with cultivation or to modify the physical condition of the soil.

Several small areas of very fine sandy loam texture were included in mapping. One such area lies just west of Los Alamos, two small bodies occur at and one-half mile east of Buellton, and one small body occupies a lower fan about 4 miles south of Santa Rita. A few included areas have very slightly calcareous surface soils. If extensive these areas would have been differentiated as a soil of the Agueda series.

Typical areas of Salinas gravelly loam are in the Alamo Pintado Creek bottoms from near its junction with Santa Ynez River to its source, others occur on alluvial-fan slopes and in creek bottoms 5 miles east of Santa Ynez, and small bodies lie south of Santa Rita. Areas occupy alluvial-fan slopes and creek bottoms well above stream overflow. This is an immaturely weathered soil of mixed origin. Good drainage renders it well suited to irrigation where water is available.

About 90 per cent of the soil is under cultivation, principally to alfalfa, barley, and beans. Alfalfa is produced under irrigation, and yields of 5 or 6 tons of hay to the acre are obtained. Barley yields from 10 to 20 sacks to the acre and beans from 8 to 12 sacks. Better yields are obtained in favorable seasons under good cultural practices.

This soil is seldom sold alone but is valued higher than the hill and terrace soils with which it is generally associated. It is productive, and under good management returns are very satisfactory.

SALINAS GRAVELLY CLAY LOAM

To a depth of 8 or 10 inches the surface soil of Salinas gravelly clay loam consists of very dark dull grayish-brown, dark-gray, or black gravelly clay loam. The upper part of the subsoil consists of very dark dull grayish-brown or nearly black slightly compact gravelly sandy clay loam, loam, or clay loam containing no gravel. At a depth ranging from 36 to 45 inches this layer is underlain by dull-gray or brownish-gray moderately compact calcareous loam or clay loam containing a large proportion of sandy materials, generally of a gravelly character. The surface soil contains a large amount of fine sand, which with numerous small angular or subangular gravel makes cultivation easy. The land bakes or crusts badly if not cultivated following heavy rains. The soil is immaturely weathered.

This soil is most typical and extensive in the eastern part of the area, particularly in the Santa Agueda Creek bottom. A number of areas occur in creek bottoms east of that place, and one small area is in Lompoc Valley about 2 miles west of Lompoc. The land surface is smooth and gently sloping, and tracts are well suited to cultural operations and irrigation. Though the soil occupies creek bottoms and alluvial-fan slopes, drainage is well developed and areas are not overflowed at the present time.

About 85 per cent of the Salinas gravelly clay loam is under cultivation, largely to barley and beans without irrigation. Crop yields are similar to those obtained on the gravelly loam of this series.

The soil is productive and has about the same value as other bottom soils with which it is associated.

SALINAS CLAY

Salinas clay has a surface soil, from 8 to 12 inches deep, of very dark brownish-gray, dark dull grayish-brown, or nearly black clay which contains moderate amounts of fine sand and very fine sand. The subsoil to a depth ranging from 36 to 45 inches consists of slightly or moderately compact dark brownish-gray or dull grayish-brown clay or clay loam. The lower part of the subsoil to a depth of 6 or more feet is lighter brownish-gray or grayish-brown calcareous clay loam. The clay is typically somewhat darker colored than other members of this series.

A small area in the lower Lompoc Valley 3½ miles west of Lompoc and one 2 miles west of Ballard are of somewhat heavier texture than typical, but are not differentiated on the map because of their small extent. Typical areas are a few miles west of Lompoc, in the Alamo Pintado Creek bottom, at Careaga in the Los Alamos Valley, elsewhere in the Los Alamos Valley, and in stream bottoms tributary to that valley. The soil occupies stream bottoms and alluvial terraces well above present overflow of streams. It is of mixed origin, is immaturely weathered, and is well drained. It is suited to irrigation and cultural practices.

Salinas clay is all under cultivation. Baby Lima and small white or navy beans, mustard, alfalfa, sugar beets, and grain are grown on it. Alfalfa is cut five or six times a season, and yields average about a ton to the acre at each cutting. Red mustard yields about 10 sacks to the acre, and yellow mustard 8 or 9 sacks. Grains and beans yield equally well.

When sold alone this soil is held at a price between $150 and $500 an acre. The higher-priced lands are irrigated and conveniently located with respect to market.

Rotation and the turning under of barnyard manure or cover crops will help greatly in maintaining the productiveness of this soil.

ELDER FINE SANDY LOAM

The surface soil of Elder fine sandy loam consists of dark dull grayish-brown or dark dull brownish-gray fine sandy loam from 10 to 15 inches thick. The subsoil is stratified dark dull brownish-gray loam, fine sandy loam, or clay loam. The lower part may contain much angular or subangular shale gravel. The surface soil and subsoil are loose and friable, and the soil is readily permeable to moisture or plant roots.

This soil is typically developed in the Santa Rosa Creek bottoms and in a number of smaller creek bottoms farther west. Small areas are in the San Antonio Valley, in the Los Alamos Valley, and along streams tributary to these valleys. A few small areas are in the San Julian Valley.

Elder fine sandy loam is a recent alluvial soil of mixed origin, which occupies creek bottoms subject to occasional overflow. The land surface on which it occurs is generally smooth, with sufficient slope to allow good drainage.

This soil is all under cultivation and is valued highly for the production of beans, mustard, barley, and a number of other crops. Yields of beans are generally good, and moisture conditions are such that a fixed rotation is possible regardless of the season. Baby Lima beans produce from 10 to 16 sacks to the acre and the small white variety yields about the same. The yields of mustard and barley are equally satisfactory. Sugar beets yield well in fields free of disease.

When sold alone the land is valued at $200 or $300 an acre. It is easily cultivated and maintained in good physical condition. A rotation is essential to maintain productivity and, especially in fields devoted to sugar beets, to keep the soil free from disease. With water available for irrigation the soil should prove valuable in the production of fruit, nuts, and truck crops.

Elder fine sandy loam, gravelly phase.—To a depth ranging from 10 to 14 inches, the surface soil of the gravelly phase of Elder fine sandy loam consists of dark dull grayish-brown or dark dull brownish-gray fine sandy loam containing much small angular shale gravel. The gravel interferes somewhat with cultivation and tends to make the soil dry out more quickly in hot weather than does the typical soil. The subsoil is dark dull brownish-gray gravelly loam, gravelly fine sandy loam, or gravelly clay loam which is more or less stratified. Surface soil and subsoil are loose and permeable, without marked compaction or development of a heavier-textured subsoil horizon.

This soil is extensive in the northeastern part of the area. Many tracts are in stream bottoms draining the bench lands in the vicinity of Santa Ynez, a number occur in the vicinity of Buellton, in stream valleys along the south side of the Los Alamos Valley, and several are in minor drainage ways to the north and east of Santa Rita. A large area is in Foxen Canyon. The land has a smooth surface, except where broken by gullies formed by varying currents of water during overflow. Drainage is well developed, and the soil seems well suited to irrigation. It is of mixed origin.

Practically all the gravelly phase of Elder fine sandy loam is under cultivation. Its value is somewhat lower than of the typical soil, and yields are generally somewhat lower, but the crops grown are the same.

This soil bakes or crusts badly unless cultivated soon after rains. The addition of organic matter will do much to correct this condition and will also improve the water-holding capacity.

ELDER GRAVELLY CLAY

The surface soil of Elder gravelly clay consists of very dark-gray or dark dull grayish-brown gravelly clay from 10 to 15 inches thick. The subsoil is stratified and ranges in color from dark gray to dull brownish gray and in texture from gravelly loam to gravelly clay. The proportion of gravel in the surface soil is generally not excessive; in the subsoil the proportion varies considerably in different strata. A few small gravel-free areas of somewhat heavier texture have been included because of their small extent. One such area is in the mouth of Pine Canyon northwest of Lompoc, and two are in the lower San Julian Valley.

Typical areas of Elder gravelly clay are south and west of Lompoc, 2 miles west of Las Cruces, and in the high rolling mesa country north and west of Lompoc. The land is smooth and gently sloping. The relief is favorable to cultural operations and affords good drainage.

Practically all the soil is cultivated to crops adapted to local conditions. Yields are about the same as on Elder fine sandy loam and the two soils are similar in value.

Suggestions given for the improvement and utilization of the fine sandy loam of this series apply also to the gravelly clay.

ELDER SANDY LOAM

The surface soil of Elder sandy loam, to a depth ranging from 8 to 12 inches, consists of dark dull-brown or dark dull grayish-brown mellow sandy loam of fine texture. The subsoil, to a depth of 6 or more feet, is composed of dark dull-brown, dark dull grayish-brown, or dark brownish-gray stratified sediments generally of fine sandy loam or sandy loam texture. The surface soil crusts or bakes badly unless cultivated while still moist. If worked at the proper moisture content, a mellow, friable seed bed can be prepared. A few small areas of fine sandy loam texture, not markedly different from the typical soil, were included in mapping.

Elder sandy loam is extensive in the Los Alamos Valley, particularly in the vicinity of Harriston and northeast and northwest of Los Alamos. Small areas also occur in some of the smaller valleys north and west of Buellton, in the vicinity of Santa Rita, and in adjacent valley bottoms to the east and west.

This is a recent alluvial soil. Areas are smooth and gently sloping, and drainage is well developed. Overflows follow unusually heavy storms during the winter.

About 85 per cent of the soil is under cultivation mainly to mustard, sugar beets, beans, and barley. Yellow mustard yields 8 or 9 sacks to the acre and red mustard 1 or 2 sacks more, but higher yields are possible under good management and in favorable seasons. Sugar beets yield from 10 to 15 tons to the acre.

When sold alone this soil commands between $150 and $300 an acre. A part of it is under irrigation and is held at a higher figure.

Elder sandy loam can be improved by a fixed rotation, especially where it has been cropped to sugar beets for a number of years. A rotation does much to keep the fields clean of insect pests and obnoxious weeds, and improves the fertility.

Small areas of this soil join with the closely related Dublin loam of the Santa Maria area, and one small area joins with Madera loam of that survey in a locality in which unimportant narrow areas of alluvial stream-bottom soils were not differentiated.

Elder sandy loam, gravelly phase.—The surface soil of Elder sandy loam, gravelly phase, to a depth ranging from 8 to 12 inches consists of dark dull-brown or dark dull grayish-brown gravelly sandy loam. The subsoil is stratified dark dull-brown or dark dull brownish-gray gravelly sandy loam or loam. The gravel consists largely of small angular or subangular shale fragments. It is not generally present in excessive amounts but interferes somewhat with cultivation and increases the tendency of the soil to dry out quickly in warm weather.

This gravelly soil occurs in a number of small valleys southwest and west of Lompoc and in the vicinity of Casmalia and Palmer. Two small areas are in the upper end of Foxen Canyon. Tracts are smooth, except locally where surface wash has gullied the land. The soil is a recent alluvial deposit of mixed origin, which occupies stream bottoms subject to occasional overflow. Drainage is good, except during periods of overflow.

The land is largely under cultivation and returns fair yields of grain, beans, and mustard, somewhat lower yields, however, than those obtained on Elder sandy loam. Suggestions for the improvement and utilization of the typical soil apply equally well to the gravelly phase.

AGUEDA SANDY CLAY

The surface soil of Agueda sandy clay consists, to a depth ranging from 10 to 14 inches, of dark-gray, dull grayish-brown, dark brownish-gray or black calcareous sandy clay. The subsoil is friable dark dull brownish-gray or black calcareous stratified clay loam or clay. Locally the 4 or 5 inch surface layer is not calcareous and in places the subsoil shows only slight accumulations of lime owing to weathering, but the soil is youthful and shows no marked evidence of weathering. It is of mixed origin.

Several areas of gravelly texture were included in mapping. These areas, which are shown on the accompanying soil map by gravel symbols, do not differ markedly from the typical soil, but under cultivation the gravel is some hindrance and causes these areas to dry out more quickly than the typical soil. Such areas occur in the lower San Julian Valley and are most extensive 4 miles east of Santa Ynez.

The typical soil occurs largely in the San Antonio Valley, where it occupies an area of several hundred acres; a small area occurs just south of Harriston; another is in the upper part of Foxen Canyon; and an area embracing 40 or 50 acres is 3 miles southeast of Lompoc.

Agueda sandy clay is a recent-alluvial soil occupying stream bottoms slightly above present overflow of the streams which it borders. Areas are smooth and almost flat or very gently sloping, and drainage is well developed. The soil is well suited to irrigation. Frequent cultivation is necessary, however, to prevent surface crusting.

Sugar beets, beans, mustard, and grains are the principal crops. Many of the fields devoted to sugar beets have become diseased, owing to improper management, and yields are low. Other crops give profitable returns, and it is suggested that fields be given over to these crops long enough to rid the soil of disease. When sold alone the soil brings from $200 to $450 an acre.

Crop rotation and the turning under of organic matter are essential to any permanently profitable system of agriculture. With future intensified farming operations the soil should prove productive of alfalfa, truck crops, and other crops.

Agueda sandy clay, heavy phase.—To a depth ranging from 10 to 14 inches, the heavy phase of Agueda sandy clay consists of dark-gray, very dark dull grayish-brown, or black calcareous clay. The subsoil is calcareous dark-gray or dark brownish-gray friable clay or clay loam.

This heavy soil is not extensive. An area of slightly more than 100 acres occurs in the Lompoc flat one-half mile south of Artesia School, and one of about the same size is in the lower San Antonio Valley. Drainage is generally good, though high water occasionally floods tracts for short periods during winter. The land surface is smooth and almost flat and is well adapted to irrigation and cultural practices.

All this soil is under cultivation to the same crops as are grown on Agueda sandy clay. The value of the two soils is about the same, though because of its heavy texture the phase is somewhat harder to handle. It is moderately well supplied with organic matter, and yields are similar to those obtained on the typical soil.

AGUEDA SANDY CLAY LOAM

The surface soil of Agueda sandy clay loam is from 10 to 14 inches thick and consists of dark brownish-gray or dull grayish-brown calcareous sandy clay loam. The subsoil is more or less stratified but in general consists of dark-gray, dark brownish-gray, or grayish-brown calcareous sandy clay loam or clay. The surface soil is generally well supplied with organic matter, and is easily worked into a good seed bed under cultivation. Some variation occurs locally in the texture of the surface soil, owing to surface wash in times of high water. A small area of gravelly fine sand texture was included in the lower San Antonio Valley 3 miles from the ocean.

Agueda sandy clay loam is not an extensive soil. Two patches are 4 miles south of Casmalia, two in the lower San Julian Valley, and others in the Alisal Creek bottom south of Solvang. Areas are smooth and well suited to cultivation and irrigation, and drainage is good.

This soil is all under cultivation to sugar beets, grains, and beans. Sugar beets yield from 10 to 20 tons to the acre, with an average of 12 tons, but better yields are possible if care is exercised to keep the fields free from disease by the use of a rotation. Beans and barley give good yields, and crop failures are rare.

Agueda sandy clay loam is not sold alone but is valued highly. It is mellow, easily cultivated and maintained in good tilth, and can be used in the production of a wide range of crops suited to this locality.

AGUEDA CLAY ADOBE

To a depth ranging from 10 to 14 inches the surface soil of Agueda clay adobe consists of dark-gray or black calcareous clay which on drying checks progressively into small angular granules and develops a pronounced adobe structure. The surface soil is well supplied with humus which gives it its dark color. The subsoil is typically dark-gray or black highly calcareous clay.

Included areas are considerably lighter textured in the subsoil. Such areas generally are somewhat grayer or locally brownish gray. In places the surface soil contains little or no lime to a depth of 10 or 12 inches. An included gravelly loam area lying south of Santa Rosa Hills is shown on the soil map by gravel symbols. It has the same soil profile and practically the same value as the typical soil.

Agueda clay adobe occurs largely in the upper San Julian Valley. Small bodies are north and northwest of Las Cruces, a small area occupies a narrow stream valley 5 miles south of Santa Rita, and a number of patches are in the lower San Julian Valley. This is a recent-alluvial soil of mixed origin. Tracts are smooth and flat or gently sloping, and drainage is adequate.

Agueda clay adobe is practically all under cultivation, principally to beans and barley, though small plantings of mustard, oats, and a number of other crops do well. The soil has about the same value as soils with which it is associated.

Care must be exercised in handling this soil, as it is easily puddled if worked when too wet.

CACHUMA GRAVELLY FINE SANDY LOAM

Cachuma gravelly fine sandy loam to a depth ranging from 7 to 10 inches is rich-brown or light reddish brown gravelly fine sandy loam which is friable and mellow when wet but becomes baked and hard on drying. The upper part of the subsoil to a depth between 14 and 20 inches consists of light reddish-brown or dark rich-brown gravelly fine sandy loam of firm but somewhat granular structure. Roots penetrate the material very readily, and numerous cavities facilitate water and air movement. This layer grades abruptly into reddish-brown or dark chocolate-brown dense waxy gravelly clay which when dry breaks into coarsely cloddy material. Joints or cracks are glazed with colloidal material. The clay layer grades, at a depth ranging from 30 to 48 inches, into brownish-gray or grayish-brown compact slightly cemented gravelly sandy clay. Gravel constitutes 50 per cent or more of the soil mass. Soil aggregates between the gravel are more or less glazed with a somewhat red colloidal deposit.

This soil is rather extensive, occurring principally on the higher terraces in the vicinity of Santa Ynez. Areas border many of the creeks draining the hill lands north and east of that town; others are about 5 miles west of Harriston.

Cachuma gravelly fine sandy loam has a smooth terracelike relief, broken here and there by narrow steep-sided drainage ways. Some areas are gently undulating or rolling, with the heavy clay subsoil nearer the surface than typical. Surface drainage is good, but owing to the character of the subsoil, water penetrates it slowly and results in many boggy areas during periods of wet weather.

The native vegetation consists largely of grasses with scattered oaks. About 40 per cent of the soil is under cultivation, principally to barley and grain hay. Some small white beans and baby Limas are produced when moisture conditions are favorable. In an orchard of peaches and apricots on this soil, many trees have made unsatisfactory growth, and yields are low. Barley and beans give equal or slightly lower yields than on Cachuma fine sandy loam.

When sold alone this soil commands from $75 to $125 an acre.

The soil needs organic matter which can best be supplied by turning under cover crops. In pasturing, care must be exercised not to puddle the surface soil when the ground is wet. Deeper plowing to break up any plow sole present is also advisable.

CACHUMA FINE SANDY LOAM

The surface soil of Cachuma fine sandy loam to a depth of 8 or 10 inches is light reddish-brown or rich-brown fine sandy loam containing a large amount of very fine sand. The upper part of the subsoil, to a depth ranging from 15 to 24 inches, consists of light reddish-brown or rich-brown slightly compact fine sandy loam which breaks into a finely granular structure when disturbed. The lower part of the subsoil consists of dull-brown or reddish-brown compact heavy plastic clay containing some gravel. This material rests, at a depth between 30 and 40 inches, on a brownish-gray extremely compact gravelly sandy clay loam substratum. This layer is not cemented and water penetrates it slowly, though there are places where it, together with the clay horizon above, very materially retards root development. In some included small areas the clay accumulation is below a depth of 40 inches. The soil is low in organic matter and in many cultivated areas a plow sole lies at a depth of 4 or 6 inches.

Cachuma fine sandy loam is comparatively unimportant areally and agriculturally. Three areas occur on the north side of Santa Ynez River east of Santa Ynez, one is 4 miles northeast of Santa Ynez, one 1 mile west of Santa Ynez, and another 1½ miles east of Buellton. The soil occupies alluvial terraces generally 50 or more feet above the stream bottoms. Areas are smooth and gently sloping or gently undulating. Surface drainage is good, but owing to poor subdrainage the soil generally becomes boggy following heavy rains.

Virgin Cachuma fine sandy loam is carpeted with grasses and supports scattered oak trees. About 30 per cent of the land is now under cultivation to barley, oats, or beans. Beans are generally planted only in years of good moisture supply. Barley yields from 8 to 16 sacks to the acre, depending on the season, and beans an average of about 8 sacks. When sold alone this soil is valued at a price between $80 and $125 an acre.

Cachuma fine sandy loam is productive when supplied with ample moisture. It would be very difficult to irrigate, however, owing to the comparative imperviousness of the subsoil. Under cultivation special treatment should be used to break up the generally prevalent plow sole.

ZACA CLAY

The surface soil of Zaca clay, to a depth ranging from 8 to 12 inches, consists of dark-gray or black clay. It is well supplied with humus and on drying checks and cracks until it assumes somewhat of a small cloddy or granular adobe structure, which makes it comparatively easy to cultivate. The upper part of the subsoil, to a depth ranging from 28 to 40 inches, consists of slightly compacted dull-brown or dark-gray clay. The lower part of the subsoil is light grayish-brown clay which becomes somewhat lighter in texture over the bedrock. The soil is developed by weathering in place from calcareous sandstone or impure limestone which generally lies at a depth ranging from 30 to 45 inches. Locally the soil is shallower and numerous fragments of rock may be scattered over the surface and through the material. The subsoil is highly calcareous, and the surface soil typically contains considerable lime.

Zaca clay is prominently developed 1 mile north of Las Cruces and in the foothills south of Solvang. A large area is west of Los Olivos, and other areas occur northwest of that point in the vicinity of La Zaca Canyon. Several border Santa Agueda Creek. The soil occurs elsewhere throughout the area in association with other residual soils.

Areas of Zaca clay are rolling or hilly and are generally favorable to cultural operations. Drainage is well established.

About 30 per cent of the soil is under cultivation, being devoted chiefly to beans and barley. In general beans are not planted except in seasons of heavy rainfall. The soil supports a heavy growth of grass when not cultivated and is valued highly for grazing.

When sold alone soil of this kind is valued between $40 and $80 an acre, depending on location and depth of the material.

ALTAMONT FINE SANDY LOAM

The surface soil of Altamont fine sandy loam, to a depth ranging from 7 to 10 inches, is rich grayish-brown or light reddish-brown fine sandy loam of light texture and granular structure. It is low in organic matter but takes moisture readily and when well cultivated retains it well. The subsoil, to a depth between 18 and 24 inches, consists of dull-brown fine sandy loam or loam which is somewhat compact until disturbed, when it becomes granular or cloddy. The lower part of the subsoil is friable brown or light-brown fine sandy loam which becomes somewhat lighter in texture before it grades into parent sandstone bedrock at a repth ranging from 20 to 45 inches.

In included small areas the subsoil from a depth of 20 or more inches to bedrock consists of heavy loam or clay loam. Such variations occur largely in swales and where the parent rock consists of coarse-grained shale. The surface soil is typically noncalcareous, but in included areas the deeper subsoil effervesces feebly with dilute hydrochloric acid.

Altamont fine sandy loam occurs only in the mountainous country occupying the south-central part of the area. Three small areas are 2 miles north and two areas about 4 miles northeast of Las Cruces. An area of 2 or more square miles occurs in the San Julian Valley 6 miles west of Las Cruces, and several others are in the same vicinity. The soil has a hilly or mountainous relief and is well drained. The steeper areas are subject to erosion, and care must be exercised in their cultivation to prevent it.

Under virgin conditions the natural growth consisted of scattered oaks and brush with grasses in the intervening spaces during the wetter months of the year. About 60 per cent of the land is under cultivation. Lima beans give very good yields in seasons of normal rainfall. When moisture is scarce the fields are planted to wheat or barley. Crop yields are somewhat less than on Altamont clay.

ALTAMONT CLAY

Altamont clay to a depth between 8 and 12 inches consists of dull-brown or brown clay of somewhat granular structure. This soil is somewhat duller in color than Altamont fine sandy loam. It absorbs moisture readily and retains it well under good cultural

practices. The subsoil consists of brown or light grayish-brown clay, slightly compacted but of granular structure when disturbed. It contains a great number of root cavities of more or less regular or continuous outline. At a depth ranging from 24 to 40 inches, the subsoil grades into material of lighter texture and rests on bedrock of partly weathered sandstone or shale, from which the soil is derived. When tested with soiltex the surface soil gives a neutral or slightly acid reaction.

Altamont clay, as mapped, includes some small areas in the San Julian Valley in which the subsoil appears to be of somewhat heavier texture than typical. Such areas are generally derived from heavier-textured shales or sandstones. Other small inclusions have a slightly calcareous subsoil.

This soil, like Altamont fine sandy loam, occurs almost exclusively in the south-central mountainous part of the area. One of the largest bodies occupies a high rolling ridge about 4 miles northwest of Las Cruces, a smaller tract is on the gently sloping hills bordering Nojoqui Creek 4 miles northeast of Las Cruces, and many small areas occupy the more level benches in the mountains in this locality. The only areas north of Santa Ynez River are 7 miles northeast of Los Olivos and near Casmalia. The relief is rolling, hilly, or mountainous, and drainage is well developed. Except on the steeper areas, the soil is well suited to cultural practices.

Live oaks and valley oaks occupy the soil under virgin conditions, and intervening parklike areas are covered with grass during the winter and spring. In seasons of heavy rainfall alfilaria, bur clover, pigeon grass, and wild oats form a dense growth several inches high and afford excellent pasture. About 40 per cent of the soil is cultivated. Barley yields average between 10 and 18 sacks to the acre, and baby Lima beans yield from 6 to 12 sacks, depending on the season.

This soil commands from $50 to $80 an acre, though some of the more accessible, flatter areas are held at a somewhat higher price. Areas devoted to pasture are held at $10 or $15 an acre.

The practice of a rotation, including a bean crop every second or third year, and the turning under of a cover crop occasionally would benefit the soil materially and aid in maintaining productivity.

Altamont clay, dark heavy phase.—To a depth ranging from 8 to 12 inches, the dark heavy phase of Altamont clay consists of dull grayish-brown, dark bluish-gray, or slate-colored clay containing sufficient organic matter to make it break up readily into a granular seed bed under favorable conditions of moisture and cultivation. When not cultivated the soil bakes and cracks badly on drying. The subsoil consists of dull-brown, dull brownish-gray, or slate-colored clay resting on shale bedrock at a depth between 24 and 40 inches.

Included with this soil are several small areas, having a dark-gray or almost black surface soil and dark-gray subsoil, which, if more extensive, would probably have been mapped as Diablo soils. Two small areas of this kind are on the lower foot slopes north and west of Las Cruces, and two are near the headwaters of Alisal Creek. Another included variation, represented by two or three small areas in the lower San Julian Valley, shows a mildly calcareous subsoil.

Profile of Montezuma clay. Effervescence begins at point indicated by hammer

The dark heavy phase of Altamont clay occurs in a dozen or more small areas in San Julian Valley about 7 miles west of Las Cruces and in a few places in the lower San Julian Valley on Salsipuedes Creek. Areas also lie 4 miles north and 7 miles northeast of Las Cruces. The soil occurs mainly on the lower benches or low ridges near the junction of drainage ways and has a rolling or hilly relief, in many places rather steep for cultivation. Surface drainage is good, though the soil is somewhat subject to seepage from higher-lying lands.

The native vegetation consists largely of grasses, with occasional oaks and patches of brush. About 50 per cent of the soil is under cultivation, and good yields of barley, baby Lima beans, and small white beans are obtained. The soil is somewhat more difficult to handle than typical Altamont clay and is not valued so highly.

TIERRA FINE SANDY LOAM

Tierra fine sandy loam has a dull grayish-brown or very dark brownish-gray surface soil from 8 to 14 inches thick. The subsoil consists of an upper layer of dark-gray, dark grayish-brown, or nearly black sandy loam or clay loam continuous to a depth ranging from 18 to 24 inches, and a lower layer which to a depth between 32 and 45 inches is dark-gray, dark brownish-gray, or black stiff plastic sandy clay, containing a rather large proportion of coarse sand and small gravel. This layer rests on an extremely compact or partly consolidated substratum of old sedimentary deposits, which is generally more firmly cemented with silica or iron in the upper part and less cemented, though still of semiconsolidated character, at greater depth. In included areas in swales and on foot slopes the substratum occurs at a depth of 60 or more inches. The surface soil shows a slightly acid reaction with soiltex.

Several small areas of this soil occur on the upper terraces bordering the higher hill soils between Solvang and Buellton and west and northwest of Buellton. Areas also border the Los Alamos Valley on both the north and south. A rather large area occurs near the head of Howard Canyon, and another is 1 mile west of Palmer. Other tracts are in the vicinity of the coast, west of Casmalia, and one of the largest occupies the higher hill slopes 2 miles south of Santa Rita. Many patches are in this same general vicinity, occupying the lower hill and terrace slopes. Surface drainage is well developed, but a heavy impervious subsoil retards the downward movement of water, and following heavy rains the soil over the impervious clay and substratum becomes saturated and boggy.

Under virgin conditions Tierra fine sandy loam is covered with a good growth of native grasses during winter, spring, and early summer. The soil dries out quickly when not cultivated, and the grass becomes parched and brown. About 35 per cent of the land is under cultivation. In general it is not regarded highly for agriculture, though some of the better areas produce good crops of beans and barley in favorable seasons. Barley yields from 6 to 18 sacks to the acre and small white beans and baby Lima beans from 5 to 12 sacks. The soil is not generally planted to beans unless the rainfall has been normal.

When sold alone this soil is valued at $50 or $100 an acre, depending on location and improvements.

The heavy impervious subsoil and substratum make this soil rather unproductive and limit its value for future development. It is not adapted to irrigation.

A small area of Tierra fine sandy loam joins with Altamont clay loam in the Santa Maria area. The Tierra series has been established since the earlier survey and includes the lighter-textured material.

Tierra fine sandy loam, light-colored phase.—The surface soil of Tierra fine sandy loam, light-colored phase, to a depth ranging from 6 to 10 inches is brownish-gray or light grayish-brown rather firm dense fine sandy loam, becoming richer brown when moist. The organic-matter content is low. There is a large proportion of smooth rounded fine sand in the surface soil. When wet the material runs together badly and when dry it bakes. The subsoil is generally in two layers, the upper, to a depth ranging from 24 to 32 inches, consisting of very compact, firm, and dense pale-brown or light grayish-brown fine sandy loam, and the lower, to a depth ranging from 42 to 60 inches, of grayish-drab heavy plastic clay containing more or less gravel and coarse sand. A few reddish-brown or yellowish-brown iron stains occur in both layers, owing to imperfect drainage. The lower layer rests on a more or less cemented or extremely compacted substratum consisting very largely of marine sediments. The soil materials are very largely weathered from this material. When wet the surface soil is distinctly brown and in cultivated fields even when dry it usually has a rich-brown tint. The surface soil gives a slightly acid reaction with soiltex.

The light-colored phase of Tierra fine sandy loam is not extensive. Several areas are on the upper terraces bordering the Lompoc flats to the north, south, and east of Lompoc, and several are on terraces bordering Santa Ynez River about 5 miles south and southeast of Santa Rita.

This soil has a terracelike or slightly undulating relief. Surface drainage is good, though on the flatter areas subdrainage is restricted, and following heavy rains the soil becomes boggy. It is poorly suited to irrigation.

Light-colored Tierra fine sandy loam is not valued highly for agriculture. Barley and grain hay are the principal crops, except in seasons of heavy rainfall when some beans are grown. Crop yields are not always satisfactory, owing to the character of the subsoil. The soil can be improved slightly by the addition of organic matter.

TIERRA CLAY LOAM

The surface soil of Tierra clay loam to a depth ranging from 6 to 10 inches consists of dark dull-brown or very dark grayish-brown clay loam containing a moderate amount of organic matter. The upper part of the subsoil, to a depth between 18 and 30 inches, is dark grayish-brown heavy clay loam or clay which is firm though it contains many air or root cavities until disturbed, when it breaks up granular. The lower part of the subsoil, to a depth ranging from 30 to 48 inches consists of dark-gray or drab stiff plastic sandy clay which overlies a brownish-gray semiconsolidated substratum com-

posed of water-laid sediments and including considerable gravelly material. This soil runs together badly when wet and on drying is baked and intractable.

Tierra clay loam is not extensive, though small patches are widely scattered throughout the area. Many small areas are on the terraces south, west, and north of Lompoc where they occur mainly on the lower slopes adjoining the bottom soils. Other small areas are in San Julian Valley, in the vicinity of Santa Rosa School, and on the lower foot slopes in the rolling or hilly country bordering Los Alamos Valley.

The soil is rolling or gently undulating and surface drainage is good, but subdrainage is poor because of the heaviness of the subsoil. The land is not well suited to irrigation.

Less than 15 per cent of the soil is under cultivation; the remainder supports grass, trees, or brush and is used for grazing. The yields of hay, barley, and beans are about the same as on Tierra fine sandy loam. The land is seldom sold except in connection with other soils.

ARNOLD FINE SANDY LOAM

To a depth of 8 or 10 inches Arnold fine sandy loam is dull grayish-brown, brownish-gray, or light grayish-brown fine sandy loam. The subsoil to a depth ranging from 20 to 26 inches consists of dull grayish-brown or light brownish-gray slightly compact fine sandy loam or loam. The deeper part of the subsoil, which rests on bedrock at a depth ranging from 32 to 45 inches, consists of light brownish-gray fine sandy loam or loam which becomes lighter both in texture and color before grading into bedrock. On some of the flatter areas the lower part of the subsoil is heavy textured and somewhat mottled, owing to the holding up of water by the underlying bedrock. The soil material contains a high proportion of rounded quartz sand, and on drying the soil runs together and bakes badly unless cultivated. It is very slightly acid to soiltex.

Arnold fine sandy loam occurs largely in the northwestern part of the area. Several tracts occur on the more gently sloping hills to the south and southeast of Casmalia and small tracts occupy the crest and south slopes of the divide between the Los Alamos and Santa Rita Valleys northwest of Santa Rita.

This soil has a gently sloping, undulating, or hilly relief and in general occupies smoother areas than Arnold sand, though locally wind has reworked the surface soil to some extent. Drainage is generally good, though on some of the flatter areas it is somewhat restricted.

About 10 per cent of the land is cleared of brush and oaks and used in the production of barley and beans. Better yields are obtained than on Arnold sand, and this soil is valued proportionately higher. A considerable part of the uncultivated areas is open and grass covered, affording excellent grazing.

ARNOLD SAND

Under virgin conditions the surface 8 or 10 inch layer of Arnold sand consists of light brownish-gray, light grayish-brown, or dull brownish-gray loose friable sand containing a rather large propor-

tion of light-colored rounded quartz sand grains giving it a gray appearance when dry but a grayish-brown or light reddish-brown color when wet. The subsoil is light brownish-gray slightly compact sand, generally grayer than the surface soil. At a depth ranging from 24 to 40 inches the subsoil rests on softly cemented or rather feebly consolidated sandstone which is more firmly cemented in the topmost 6 or 8 inches than at greater depths. The cementing material is iron or silica. Owing to removal of soil material by erosion the soil includes areas which are shallower than typical, especially on crests of ridges or near the shoulders of hills. It contains little organic matter except in a few swales where moisture conditions are more favorable. In such localities the surface soil is darker than typical and the subsoil is of heavier texture. Such areas closely approach the Tierra soils in character.

Arnold sand is an extensive soil occurring principally along the north side of the Los Alamos Valley. Many areas are in the foothills bordering Santa Rita Valley, and more or less isolated areas are 2 miles south of Zaca.

Areas of Arnold sand are rolling, hilly, or broken. This soil and the underlying sandstone erode easily, and the land is badly cut up in places by steep-sided drainage ways or escarpments. Except in scattered swales, drainage is good or excessive.

Under virgin conditions this soil supports a few oaks and a heavy cover of low-growing brush. Here and there are open grass-covered spots. Less than 20 per cent of the land is under cultivation. Barley and beans, principally of the small white variety, are grown. Barley yields an average of about 12 sacks to the acre and beans about 7 sacks.

This soil in general commands from $50 to $80 an acre, but some areas including little waste land have a higher value.

Arnold sand needs organic matter which can best be supplied by turning under bean straw or a cover crop. Care must be exercised in cultivating the steeper areas to prevent erosion.

Areas of Arnold sand in this survey join with Altamont sand of the earlier Santa Maria area survey. Other small areas join with Altamont clay loam and Madera loam of that survey, in which the soils were mapped in less detail.

SANTA LUCIA CLAY

The surface soil of Santa Lucia clay, to a depth ranging from 7 to 12 inches, consists of dull brownish-gray or dark grayish-brown mellow granular clay having the physical character of a clay loam. The soil is well supplied with organic matter, the 1 or 2 inch surface layer in many places containing grass and brush roots in various stages of decomposition. The subsoil consists of dark grayish-brown or dark brownish-gray clay to a depth ranging from 24 to 32 inches. This layer has a somewhat jointed structure until disturbed, when it breaks up into coarse or medium clods. The lower part of the subsoil, to a depth between 34 and 45 inches, is dark brownish-gray clay loam or clay containing many partly weathered shale fragments. The subsoil rests on siliceous shale from which the soil is derived. A few flat angular chips of shale are scattered over the surface and

through the soil mass. The surface soil is commonly very slightly acid to soiltex.

Santa Lucia clay occurs widely scattered throughout the area in the mountainous or hilly sections. It is prominently developed in the Casmalia Hills north and east of Casmalia, and less extensive bodies occur in the northeastern part of the area. Several small tracts are in the San Julian Valley. The relief is hilly or rolling or, in a few places, mountainous, and drainage is good or excessive.

Under virgin conditions Santa Lucia clay is largely grass or brush covered. Much of the brush is sagebrush. About 15 per cent of the land is cleared and used in the production of beans or barley. It is shallower than soils of the Altamont series and has a lower water-holding capacity, so that crop yields are somewhat less than on Altamont clay. Beans are grown in rotation with barley in favorable seasons.

When sold alone this soil brings between $40 and $60 an acre.

Santa Lucia clay joins with Altamont clay of the Santa Maria area on the north. The Santa Lucia soils are darker than the Altamont, are derived from siliceous materials, and are entirely noncalcareous. Another area of this soil adjoins Altamont sand in the hilly and mountainous region along the boundary of the two areas. Here the soils were not mapped in detail in the earlier survey.

Santa Lucia clay, gravelly phase.—The surface soil of the gravelly phase of Santa Lucia clay is dark grayish-brown or dark brownish-gray friable gravelly clay from 8 to 12 inches thick. The subsoil is dark brownish-gray gravelly clay grading into clay loam which overlies bedrock at an average depth of about 30 inches. This soil includes some areas of dark-gray or almost black material. Both surface soil and subsoil contain an abundance of flat angular shale gravel, generally an inch or two in diameter.

An area of this soil is 5 miles south of Santa Rita, another is 4 miles west of Las Cruces, and a third is 2 miles north of that place. As mapped, typical Santa Lucia clay contains some small undifferentiated areas of this gravelly soil.

The relief is rolling or hilly, promoting good or excessive drainage. Less than 5 per cent of the land is in cultivation, the remainder being covered with oak and low-growing brush. Barley, the principal crop grown, returns low yields.

MONTEZUMA CLAY

Montezuma clay is characterized by an 8 to 12 inch dark-gray or black clay surface soil, overlying dark-gray or black jointed or roughly prismatic clay extending to a depth between 30 and 45 inches. Where exposed in cuts the subsoil checks into a medium cloddy structure. The lower part of the subsoil, to a depth ranging from 50 to 70 inches, consists of dark-gray, dull brownish-gray, or dull-brown clay containing scattered seams or soft aggregates of lime carbonate. This layer is very compact and tends to check into a small cloddy structure on drying. It is underlain by noncalcareous light brownish-gray clay or clay loam. (Pl. 1.) The lime has accumulated in the subsoil as the result of weathering

of the surface soil, which now shows no lime when tested with dilute acid. A small area of this soil in the lower San Julian Valley has a gravelly surface soil and subsoil.

Montezuma clay is inextensive. One of the largest areas occupies a fan and lower hill slope bordering Santa Ynez River 2 miles south of Santa Rosa School. Small areas border El Jaro and Salsipuedes Creeks in the lower San Julian Valley.

The relief is gently undulating or rolling, and drainage is well developed. The soil is suited to cultivation and at the proper moisture content can be worked into a mellow seed bed.

Mustard, beans, and barley are grown. Beans yield from 7 to 12 sacks to the acre, and barley and mustard yield equally well. The soil is sold only in connection with other soils.

SANTA YNEZ GRAVELLY FINE SANDY LOAM

The surface soil of Santa Ynez gravelly fine sandy loam, to a depth ranging from 7 to 10 inches, consists of very dark dull-brown, dark grayish-brown, or dark brownish-gray gravelly fine sandy loam. In virgin areas the surface soil is firm and compact or somewhat puddled and generally is noticeably firmer at a depth of 4 or 5 inches. Under cultivation it works up to a fine granular structure. The upper part of the subsoil, to a depth ranging from 18 to 24 inches, consists of very dark grayish-brown, dark-gray, or black gravelly fine sandy loam which is dense and firm in cuts but breaks up to a granular condition under moderate pressure. Roots penetrate this layer readily and their decay has left many small cavities. The underlying layer, to a depth between 28 and 34 inches, consists of lighter-gray or brownish-gray gravelly very fine sandy loam of mealy structure mottled with gray and yellow. This layer is also readily penetrated by roots, but root cavities are not numerous because much of the material is saturated during the rainy season. The material below this, or the third layer of the subsoil, to a depth between 45 and 56 inches, consists of grayish-drab stiff waxy gravelly clay which is underlain by light brownish-gray or yellowish-gray dense gravelly clay or clay loam. The layer last described is not so impenetrable to root or moisture movement as the overlying clay layer.

This soil as mapped includes some areas of very fine sandy loam free of gravel. Several such bodies border Santa Ynez River and its tributaries, Cachuma Creek and Santa Cruz Creek. in the eastern part of the surveyed area. Another included variation embraces soils of gravelly clay loam texture. Some very small areas of this character occur in the lower San Julian Valley, and one rather large area lies 4 miles east of Santa Ynez.

The typical soil occurs in a great number of comparatively small areas on the mesa surrounding Santa Ynez, on mesas and lower hill lands north and west of Solvang, and bordering a number of creeks north and west of Los Olivos. In the northeastern part of the area patches border Foxen Canyon and Canada de los Alisos and adjacent drainage ways. The soil is not extensive outside the eastern part of the surveyed area.

Santa Ynez gravelly fine sandy loam has a gently undulating or rolling relief. Drainage is adequate under natural conditions, ex-

cept following heavy storms when the tight subsoil retards downward percolation of excess moisture. The absence of subdrainage would cause more or less trouble under irrigation.

The land is largely grass covered under virgin conditions. About 60 per cent of it is cultivated to dry-farmed grain and beans. In seasons of low rainfall much grain hay is harvested. When moisture conditions are favorable barley yields from 8 to 15 sacks of grain to the acre. In seasons of normal rainfall baby Lima beans and navy beans give profitable returns if good cultural practices are followed. The soil is seldom sold alone but is valued the same as soils of the Cachuma series with which it is generally associated. In a great number of fields a plow sole has developed, and this should be broken up by deeper plowing or subsoiling.

LAGUNA CLAY LOAM

The surface soil of Laguna clay loam consists of light brownish-gray or dull-gray friable clay loam containing appreciable quantities of fine and very fine quartz sand, and is from 10 to 15 inches deep. The subsoil is light brownish-gray or dull-gray friable loam, clay loam, clay, or fine sandy loam to a depth of 6 or more feet.

Included in mapping and indicated by gravel symbols are one or two gravelly areas which are similar in all respects to the typical soil except that the gravel interferes to some extent with cultivation and the soil dries out more quickly than nongravelly areas. Gravelly areas occur 4 miles southwest of Harriston.

Laguna clay loam occupies alluvial-fan slopes and stream bottoms in Santa Rita Valley and Cebada Canyon. Tracts are moderately or gently sloping. The soil is easily cultivated and maintained in good tilth and is suited to irrigation. It is seldom, if ever, overflowed under present conditions.

The land is all under cultivation, the principal crops being beans, barley, and mustard, and the minor crops fruits and nuts. The yields of both fruits and nuts indicate that acreages of these crops could well be extended on this soil. Beans yield from 10 to 15 sacks to the acre and mustard about the same. Barley produces 15 or 20 sacks to the acre in good seasons.

When sold alone this soil is valued at a price between $250 and $500 an acre. Areas in bearing orchards or otherwise well improved are more valuable.

Laguna clay loam is a productive soil, is easily tilled, and is responsive to good cultural methods. It should prove valuable in the production of small fruits, as well as of tree fruits and nuts, and of a variety of other crops adapted to local conditions.

LAGUNA FINE SAND

Laguna fine sand is characterized by a 10 to 14 inch surface layer of light brownish-gray, medium-gray, or light-gray fine sand. The subsoil to a depth of 72 or more inches is light brownish-gray or light-gray fine sand, medium sand, or sandy loam. The surface soil contains considerable rounded quartz sand of the fine and very fine grades. It is low in organic matter, and, unless protected by windbreaks or crops, blows badly following cultivation.

Several areas of gravelly sandy loam texture which are more droughty and less valuable for crop production than the typical soil have been included in mapping and shown on the map with gravel symbols. One such area is 2½ miles southwest of Santa Rita, another is 2½ miles north of Los Alamos, a third is just south of Buellton, and a fourth is 3 miles west of Buellton.

This soil occurs in a number of places in Santa Rita Valley and in canyons to the west. The relief is smooth or slightly ridgy. The soil is of recent deposition, is loose and friable, and is well drained and fairly well suited to irrigation.

Laguna fine sand is all under cultivation and in general is well farmed. Beans and barley are the principal crops, and yields are similar to those obtained on Laguna clay loam. Walnut groves and apricot orchards give good returns.

When sold alone the land commands between $250 and $450 or more an acre, depending on the state of improvement.

With future intensive development this soil should prove valuable in the production of small fruits as well as of tree fruits and nuts. It should be well supplied with organic matter to increase the fertility and moisture-holding capacity and to bind the material against blowing and washing when irrigated.

YOLO FINE SANDY LOAM

The surface soil of Yolo fine sandy loam consists of brown or light grayish-brown fine sandy loam from 10 to 14 inches thick. The subsoil is stratified, dull grayish-brown, or brown fine sandy loam, clay loam, or sandy loam. A few areas having a slightly calcareous subsoil at a depth ranging from 40 to 60 inches were included in mapping. In other included areas the subsoil contains strata of dark-brown, dark-gray, or black material.

Yolo fine sandy loam is not extensive. It occurs entirely in the mountainous section of the area south of Santa Ynez River. Areas are on Ballard Creek, Alisal Creek, Nojoqui Creek, in the canyon southwest of Gaviota Pass and in the upper San Julian Valley.

The soil is of recent deposition and of mixed origin. It occupies stream bottoms but is rarely, if ever, overflowed. Drainage is well developed.

About 75 per cent of the land is under cultivation, chiefly to barley and beans. Barley yields from 12 to 20 sacks to the acre and beans from 10 to 15 sacks. Baby Lima, small white, and Bluepod beans are produced.

Land of this kind is not sold alone but has a higher value than most of the soils with which it is associated.

Yolo fine sandy loam is a productive soil and is generally well farmed. It is suggested that the wasteful practice of burning bean straw be discontinued and the residue plowed under to increase the organic-matter supply of the soil.

YOLO FINE SAND

The surface soil of Yolo fine sand, to a depth ranging from 10 to 14 inches, is brown, grayish-brown, or light grayish-brown friable fine sand. The large proportion of fine rounded quartz sand present

gives the layer a somewhat gray color when dry, but when wet it is distinctly brown or light brown. The subsoil is similar in color and character to the surface soil. It is loose and easily penetrated by moisture and plant roots.

Many tracts of this soil are in the western and northern parts of the area. One of the largest is just north of Harriston, several occur on the fan slopes or in stream bottoms in the same vicinity, and others, mainly small, are associated in places with soils of the Arnold and Marina series in the northern part of the surveyed area. The soil also occurs in the vicinity of Buellton.

Yolo fine sand is smooth and gently or moderately sloping. It is somewhat gullied in places by erosion, and drainage is good or excessive. The land would be difficult to handle under irrigation.

The soil consists largely of alluvial outwash from the higher-lying Marina and Arnold soils and is generally regarded as rather poor. About 50 per cent is under cultivation, largely to grain. Some of the better areas produce from 7 to 10 sacks of beans to the acre in seasons of high rainfall.

When sold alone the land is held at $100 or $150 an acre.

Yolo fine sand is chiefly in need of organic matter to improve the moisture-holding capacity and increase fertility. Fertilizing elements would be quickly leached from the soil unless some absorptive material were present.

MARINA SAND

The surface soil of Marina sand to a depth ranging from 8 to 14 inches is light-brown, brown, or light grayish-brown mellow sand. The subsoil to a depth of 72 or more inches consists of light-brown sand showing little or no compaction. Throughout the soil there is a rather high content of smooth rounded quartz sand. The soil is low in organic matter and tends to blow and erode on the steeper slopes unless covered with vegetation. The surface soil shows a distinctly acid reaction with soiltex.

The soil occurs in an area of several square miles in the vicinity of Surf. A great number of areas border Burton Mesa, and several large bodies border San Antonio Creek and the mesa south of Casmalia and north of Lompoc. A tract of about 2 square miles is in the extreme northwestern part of the area. Many bodies of different size are associated with the Arnold soils on the north side of Los Alamos Valley and in Santa Rita Valley. Marina sand has a smooth terracelike or rolling wind-blown relief, and drainage is good or excessive. The soil is believed to be largely of marine origin.

Areas not under cultivation are covered with a heavy growth of brush. Scattered open spots are covered with grass. Fair yields of barley, beans, or mustard are obtained.

The land commands from $20 to $60 an acre, depending on location and improvements.

The addition of organic matter would greatly improve the moisture-holding capacity of the soil and render it less likely to blow or erode.

Marina sand adjoins the soil mapped as Oakley sand in the Santa Maria area. In the Santa Ynez area it is believed to be more rep-

resentative of the Marina soils which differ somewhat from the Oakley of the earlier surveys.

TANGAIR SAND

The surface soil of Tangair sand, to a depth ranging from 6 to 12 inches, is medium or rather dull brownish-gray or dull grayish-brown loose friable sand containing a small amount of organic matter. The upper part of the subsoil, to a depth between 26 and 36 inches, consists of light brownish-gray, light yellowish-gray, or light-gray slightly compact sand. This layer is in places slightly mottled with rust brown or yellowish brown, owing to the presence of partly oxidized iron accumulations. The lower part of the subsoil consists of light brownish-gray or pale-yellow moderately compact sand containing numerous iron concretions or nodules of various sizes. The material is generally mottled with iron stains of rust brown and yellowish brown. As mapped Tangair sand includes some areas in which the lower part of the subsoil is somewhat heavier than typical, approaching in character the heavy-subsoil phase of this soil. In other localities the subsoil is underlain by a softly cemented substratum or sandstone rock which closely resembles that occurring under the soils of the Arnold series. Such areas are too small to be differentiated.

Tangair sand occurs almost exclusively on the Burton Mesa lying north of Lompoc Valley. The relief is gently undulating or terracelike. The soil is probably derived by weathering of old marine terrace deposits which have been somewhat reworked by the wind.

This soil is largely grass and brush covered and affords some grazing during the wetter months. About 40 per cent of it has been cleared and in seasons of heavy rainfall is planted to barley which gives satisfactory yields in favorable seasons. The crop is occasionally cut for hay when not enough moisture is present to insure a grain crop.

The land is not valued highly for agriculture nor is it believed possible to irrigate it economically. The price range is from $25 to $50 an acre.

Tangair sand, heavy-subsoil phase.—The heavy-subsoil phase of Tangair sand to a depth of 8 or 10 inches consists of brownish-gray or grayish-brown sand which contains a fair amount of organic matter. The upper part of the subsoil is brownish-gray or light-gray rather compact sand or sandy loam mottled with iron stains. This is underlain at a depth ranging from 20 to 45 inches by very compact, light grayish-drab sandy clay or clay loam mottled rust-brown and yellowish-brown with iron stains and containing some rust-brown iron concretions. Below a depth greater than 6 feet there is in most places a softly consolidated substratum or soft sandstone bedrock.

This soil occurs largely on the outer edges of Burton Mesa, where it borders areas of the typical soil. Small areas are on the lower slopes of the hills bordering Los Alamos and Santa Ynez Valleys. The relief is rolling or slightly undulating. Surface drainage is fair, but subdrainage is poor and water frequently stands in low depressions for weeks at a time following heavy rains.

Less than 5 per cent of the land is under cultivation. Barley and barley hay give fair yields in favorable seasons. The land is sold only in connection with the typical soil or with other adjoining soils.

CHAMISE GRAVELLY FINE SANDY LOAM

Under virgin conditions the surface soil of Chamise gravelly fine sandy loam to a depth of 8 or 10 inches consists of dark grayish-brown or dark brownish-gray gravelly fine sandy loam. The upper part of the subsoil to a depth ranging from 18 to 28 inches consists of granular dark-gray or dull brownish-gray moderately compact gravelly fine sandy loam or loam. The lower part of the subsoil at a depth between 28 and 40 inches but averaging about 32 inches consists of dark-gray or grayish-drab stiff plastic gravelly clay which rests on a very firmly cemented substratum consisting of sediments of heavy texture and containing more or less gravel. The substratum is extremely dense and impervious to a depth of 60 or more inches, where it becomes less cemented and grades into semiconsolidated sediments. The cementing material is silica or iron or both. The surface soil contains a fair amount of organic matter, though not sufficient to prevent the soil from running together and baking on drying. A plow sole is easily formed unless care is taken to plow at different depths from season to season. The gravel present is mainly rounded or flat shale and subangular quartzite and igneous rocks.

Chamise gravelly fine sandy loam occurs largely in the northeastern part of the area in the rolling or hilly country north of Los Olivos and Santa Ynez. A large area is just west of Ballard, and the high rolling divide between the upper Los Alamos Valley and Santa Ynez Valley at Zaca is composed largely of this soil. Two small areas north of Casmalia occupy low terrace benches.

The relief is hilly or rolling. The land appears to have been an old terrace form now greatly dissected and eroded into hills and narrow steep-banked drainage ways. Drainage is well developed, but an impervious substratum prevents free movement of water in the soil.

Less than 1 per cent of the soil is under cultivation. The remainder is covered with grass in the wetter months and supports a scattered growth of oaks on the slopes protected from the sun. The land is valued chiefly for grazing. Barley and grain hay are the principal crops, but the yields are low except on some of the deeper areas.

When sold alone this soil commands from $10 to $50 an acre. It has little potential value for agriculture, owing to its shallowness and the presence of an impervious substratum.

Chamise gravelly fine sandy loam, light-colored phase.—The surface soil of the light-colored phase of Chamise gravelly fine sandy loam consists of a surface layer, from one-eighth to one-fourth inch in thickness, of loose, granular, or single-grained pale reddish-brown or light grayish-brown gravelly fine sandy loam and a subsurface layer, continuing to a depth of 7 or 9 inches, of light grayish-brown or pale-brown compact gravelly fine sandy loam. This layer, when undisturbed, is firm though it contains many root cavities and has a somewhat spongelike character. It breaks down

to a small granular structure under slight pressure. The upper part of the subsoil is pale reddish-brown gravelly fine sandy loam, somewhat compact though not so firm as the surface material. Roots penetrate this layer readily and have left many cavities which promote aeration and oxidation. The material in this layer breaks into a fine granular mass under very slight pressure. The deeper subsoil layer of light brownish-gray or pale reddish-gray gravelly and moderately compact heavy loam or clay loam occurs between depths ranging from 18 to 22 inches and 30 to 36 inches. This layer also is readily penetrated by roots. It is underlain to a depth of 40 or 45 inches by dark reddish-brown or brown extremely compact gravelly clay or clay loam which tends to check into a small cloddy structure on drying and contains few evidences of root penetration. This layer rests on a layer of pale reddish-gray, pale brownish-gray, or brown impervious silica or an iron-cemented substratum or hardpan which is massively developed and in most places is from 36 to 54 inches in thickness. It, in turn, is underlain by extremely compact and somewhat cemented though more permeable material.

As mapped the soil includes some much shallower areas, occurring mainly near the outer margins of the soil leading to drainage ways and on the rounded ridges near the confluence of drainage ways. Several areas of this kind occur along the lower hill slopes east of Los Olivos. Another included variation consists of gravel-free areas, three of which occur near the northern boundary where Foxen Canyon leaves the area surveyed. The soil is low in organic matter and bakes or puddles easily. Plow soles are easily developed if care is not taken in cultivation.

The light-colored phase of Chamise gravelly fine sandy loam is not extensive. Tracts occur mainly in the upper part of the canyon of La Zaca Creek and near the northern boundary of the area in the vicinity of Foxen Canyon and Canada del Gato. Several small areas have also been mapped along the foot slopes of the Los Alamos Valley east of Los Alamos. Tracts are rolling or hilly or of terrace-like relief. Excess moisture moves readily over the surface, but underdrainage is restricted by the imperviousness of the subsoil. The soil is derived from an alluvial terrace deposit of mixed origin which has weathered to a very marked degree.

Less than 5 per cent of the land is under cultivation. The remainder is largely grass covered, and scattered valley oaks and live oaks give areas a parklike appearance. The land is valued chiefly for grazing. Barley and grain or wild hay give fair yields in favorable seasons.

When sold alone the soil commands from $50 to $75 an acre. It can be improved by the addition of organic matter, though the heavy subsoil and impervious substratum will always restrict its agricultural value.

Along the boundary of the Santa Ynez and the Santa Maria areas, this soil adjoins Altamont sand, a soil which has since been included with the Tierra soils.

PEAT

Peat lands occurring in the Santa Ynez area are in a raw uncultivated state. Dark-brown fibrous organic material containing very

little mineral matter forms the upper 10 to 30 inch layer. Below this there is a gradual change to very dark-brown or black rather thoroughly decomposed organic material. The subsoil contains more or less mineral matter, though it is composed largely of plant remains. In the only tract of peat occurring in the area the depth of the organic material ranges from 2 to 4 feet near the outer edges of the body and from 15 to 20 or more feet in the center.

Peat occurs in one area of about 500 acres in the upper San Antonio Valley. It occupies a low, poorly drained depression and at present is covered with willows, cattails, sedges, and other water-loving plants. Very recently a drainage outlet has been provided and a part of the land has been dredged to provide drainage ways preparatory to reclamation.

This class of land has little or no value in its present condition, but when drained it should prove one of the more valuable soils of the area. Under future development it should become well suited to onions, potatoes, cabbage, asparagus, and a great number of other vegetables, and also to corn and oats.

ROUGH BROKEN LAND

Throughout the surveyed area, especially along the eastern and southern boundaries, are tracts of land too rough and broken to allow agricultural development. Such land is designated rough broken land. It includes steeply sloping or eroded old alluvial deposits which are at present partly consolidated. Such areas occupy the lower situations. The higher-lying areas are generally composed of soil materials which, if suitable for agriculture, would be classified with either the Altamont or Santa Lucia series. These areas have a shallow soil covering underlain by sandstone or shale bedrock. In the northeastern part of the area some tracts are rough and stony and if more extensive would have been mapped as rough stony land. Here the soil is shallow, and shale, granite, and basalt bedrock outcrops over extensive areas. Rough broken land joins with an area of Altamont clay loam of the Santa Maria area.

Rough broken land is extensive in the Santa Ynez area. Tracts are associated with agricultural soils throughout the northern, southern, and eastern parts. The land is covered with oaks, with some pine on the upper elevations and in canyons protected from the sun, and with brush on the more shallow areas. During winter, spring, and early summer the land is covered with grass and affords excellent grazing, and, aside from this, has no agricultural value.

COASTAL BEACH AND DUNE SAND

In the western part of the surveyed area bordering the ocean are long stretches of sandy coastal beach on which there is no plant life. Strong winds sweeping inland pick up much of the sand at low tide and carry it onto the adjacent uplands, forming sand dunes of various sizes. The dunes bordering the ocean are also bare of vegetation and shift continuously with the wind. Farther inland some sagebrush and other brush have secured a foothold and the dunes are not moving to a very great extent. During the rainy season grass sprouts between the dunes and around the brush, affording some

feed for livestock. Coastal beach and dune sand is not valued, except for the grazing it affords.

Several square miles of dune sand with a comparatively narrow strip of coastal beach border the ocean at Narlon. Another long narrow tract composed more largely of coastal beach extends from the mouth of Santa Ynez River south to the boundary of the area.

RIVER WASH

River wash occurs along Santa Ynez River and includes material which is overflowed periodically and which, owing to unfavorable texture and position, has no agricultural value under existing conditions. It is composed mainly of gravel and sand, but many cobbles and larger stones are present in the eastern part of the area. In the central and western parts the material is finer textured, consisting of fine sand or fine sandy loam with little or no gravel and cobbles. If agricultural, the soil would be classed in the Metz series.

River wash is covered with willows in places, but in many of the lower areas which are overflowed every season it is barren of vegetation. Some grass on river wash gives it slight value for grazing.

SUMMARY

The Santa Ynez area is in Santa Barbara County, Calif. It includes the valley of Santa Ynez River from the Pacific Ocean to the upper limits of agricultural development and San Julian, Los Alamos, and San Antonio Valleys with contiguous and intervening areas. The included area is 754 square miles, or 482,560 acres.

The area consists of a number of narrow valleys separated by low hills or mountains. The principal drainage ways are Santa Ynez River and San Antonio Creek. Bordering the main drainage ways and many of the tributaries are a series of elevated terraces, more or less dissected by erosion. The terraces merge into rolling hill lands made up largely of more elevated former terrace deposits which in turn merge into steep rocky mountain slopes. Bordering the ocean are a number of comparatively level terraces or mesas, probably of marine origin. Except in Lompoc Valley, the recent-alluvial soils bordering the streams occupy narrow bottoms.

Elevations within the area range from slightly above sea level to 1,500 feet on some of the upper terraces and 3,000 or more feet on the mountain tops. The general slope is westerly.

Except locally along the ocean and in an area in San Antonio Valley the soils are well drained.

Santa Barbara County was created February 18, 1850, and was one of the 27 original counties of the State. It was sparsely settled at that time, largely by people of Spanish descent. Lompoc is the principal town in the surveyed area. The most thickly settled parts of the area are around Lompoc, Solvang, and Los Alamos. Many outlying areas are thinly populated or unsettled.

Railroad transportation is furnished by the Southern Pacific Railroad and the Pacific Coast Railway (narrow gage). Highways over the intervening mountainous area are used to transport express, mail, and freight into the inland sections. The area is well supplied

with paved roads, and the county roads are well graded and passable throughout the year.

Telephone service, electricity for power and lighting, and other modern conveniences are in general use. Tractors are common.

Local demand absorbs only a small proportion of the crops grown. Transcontinental railroad service and ocean lines of transportation furnish access to outside markets.

The climate of the Santa Ynez area is mild, with few extremes of summer or winter temperatures. Fogs are common near the ocean.

The first attempts at agricultural development date back to the coming of the mission fathers in 1787. Fruits and grains were produced under irrigation on the mission grounds, and sheep, horses, and cattle were pastured on the hills. Agriculture fell into decline with the secularization of the missions in 1835.

Early agriculture consisted largely of the production of small grains for local consumption and of the grazing of sheep and cattle. The region was found suited to the production of fruits and vegetables, and a steady development along that line is still in progress. The bean crop is the most important crop in the area, however, fruits and nuts ranking second. Beans are grown largely in rotation with barley and mustard.

The soils of the Altamont, Zaca, Montezuma, Ballard, and Tierra series are used largely for bean and grain production. Other terrace or upland soils are devoted largely to grain. The soils of the Metz, Laguna, Elder, Botella, Agueda, Yolo, and Salinas series are used largely in growing alfalfa, beans, mustard, sugar beets, vegetables, fruits, and nuts.

Farm buildings are generally modern and well kept. Work animals are of medium weight and are well bred, and range livestock is largely of the Hereford breed.

Little money is spent on commercial fertilizers, crop rotation and the turning under of cover crops being sufficient to maintain yields.

Most of the farms are rather large. About 50 per cent are operated by owners and the remainder by tenants or managers. Most of the renting is on a share basis, the renter furnishing everything and receiving three-fourths of the crops. Lands used for growing vegetable and flower seeds are rented for cash, the rate being from $40 to $65 an acre.

The Santa Ynez area lies in the Pacific coast soil region. The parent soil materials are largely from sedimentary rocks.

The residual soils are placed in two groups, one including soils developed from the weathering in place of the harder rocks, and the other from the weathering of softer and irregularly consolidated sedimentary deposits. The former group embraces the Altamont, Santa Lucia, and Zaca soils, and the latter soils of the Arnold, Tierra, and Chamise series.

The soils developed from unconsolidated sedimentary or transported deposits are of three groups of material, the classification being based on age or degree of weathering. The more mature soils are placed in the old valley-filling group which embraces soils of the Tangair, Cachuma, Ballard, Santa Ynez, and Montezuma series. The more recent soils, which have nevertheless weathered sufficiently to produce a moderately compact or heavier-textured sub-

soil, are classified in the Marina, Botella, and Salinas series. The third group of soils embraces those of recent deposition, which are entirely unweathered. Soils of this kind are placed in the Metz, Yolo, Elder, Agueda, and Laguna series.

The series are differentiated from each other on the basis of essential differences in stage of weathering or maturity, color, drainage or other physical or chemical properties. The series are further subdivided into soil types on the basis of the texture of the surface soil, that is, the proportions of sand, silt, and clay present. The soil type is the unit of soil mapping.

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[PUBLIC RESOLUTION—No. 9]

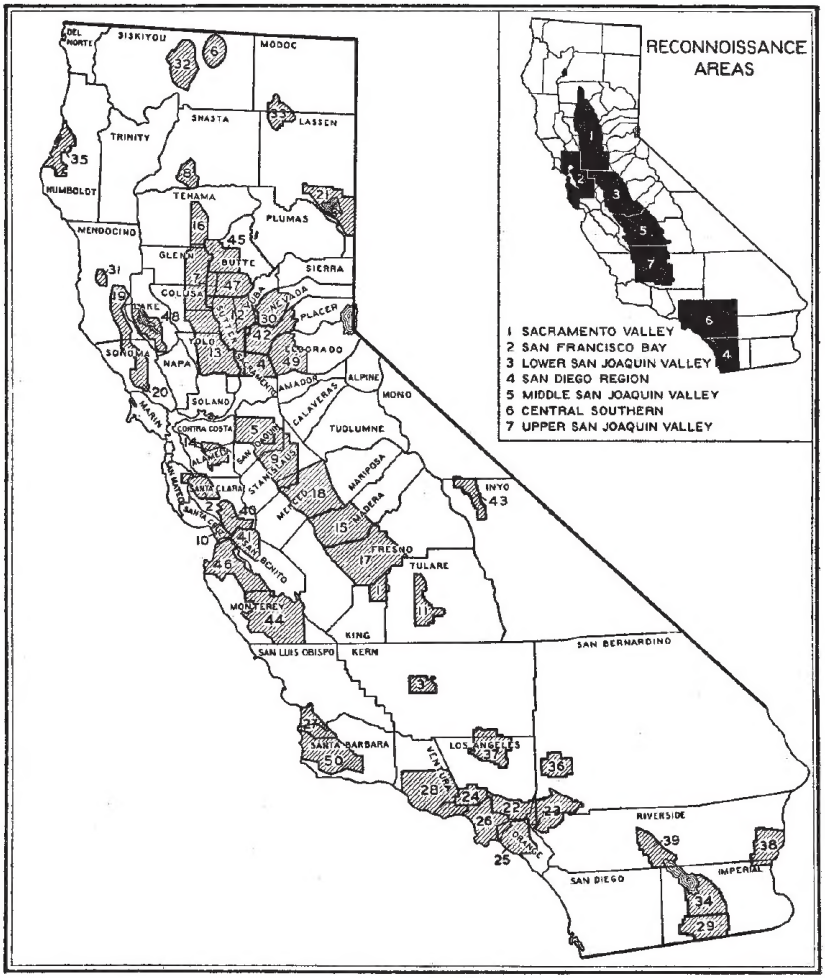
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in California, shown by shading

1. Hanford
2. San Jose
3. Bakersfield
4. Sacramento
5. Stockton
6. Butte Valley
7. Colusa
8. Redding
9. Modesto-Turlock
10. Pajaro Valley
11. Portersville
12. Marysville
13. Woodland
14. Livermore
15. Madera
16. Red Bluff
17. Fresno
18. Merced
19. Ukiah
20. Healdsburg
21. Honey Lake
22. Pasadena
23. Riverside
24. San Fernando
25. Anaheim
26. Los Angeles
27. Santa Maria
28. Ventura
29. El Centro
30. Grass Valley
31. Willits
32. Shasta Valley
33. Big Valley
34. Brawley
35. Eureka
36. Victorville
37. Lancaster
38. Palo Verde
39. Coachella Valley
40. Gilroy
41. Hollister
42. Auburn
43. Bishop
44. King City
45. Chico
46. Salinas
47. Oroville
48. Clear Lake
49. Placerville
50. Santa Ynez

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A. G. McCALL, CHIEF, SOIL INVESTIGATIONS
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
SANTA YNEZ AREA
CALIFORNIA

UNIVERSITY OF CALIFORNIA
AGRICULTURAL EXPERIMENT STATION
E. D. MERRILL, DIRECTOR
CHARLES F. SHAW, IN CHARGE SOIL SURVEY

Macy H. Lapham, Inspector, District 5.
Soils surveyed by E. J. Carpenter, in charge, and T. W. Glassey,
U. S. Department of Agriculture, and R. Earl Storie,
University of California.

BASE MAP IN PART FROM
U. S. GEOLOGICAL SURVEY SHEETS

Scale 1 inch - 1 mile

Field Operations
Bureau of Chemistry and Soils
1927